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AUSTRALIA'S NUMBER ONE ELECTRONICS MAGAZINE

ELECTRONICS AUSTRALIA

MAY 1984
AUST $2.30 NZ $2.75

STOP THIS ▶

Build our new Car Burglar Alarm

Shure V15 Type V Cartridge

Programmable light controller

CAT Computer Reviewed: colour graphics plus sound effects

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AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE

ELECTRONICS AUSTRALIA

Volume 46, No. 5, May 1984

On the cover

One of our staff members shows how easy it is for your car to be stolen. Protect your property by fitting our new Car Burglar Alarm (see p46). Inset shows the new Cat computer from Dick Smith Electronics (see p22).

Deluxe Car Burglar Alarm

Stop your car from being stolen. This new car burglar alarm features delayed entry and exit, automatic reset, a separate horn speaker, and provision for an auxiliary battery. See page 46.

Relax with the Stress Monitor

Learn to relax with our Stress Monitor. It can be used for biofeedback experiments, or you can use it as a simple lie detector. Construction starts on page 60.

Features

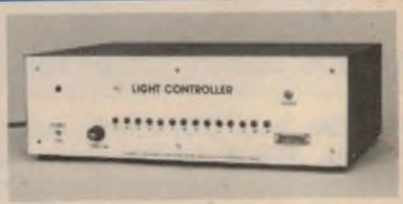
Hifi, Video and Reviews

Projects and Circuits

Personal Computers

Columns

Departments



Programmable light controller

Plug this unique project into the output port of any 8-bit personal computer and you can automatically switch up to 14 240VAC lighting channels in any pattern you desire. It's just the thing for in-home lighting control or for shop front and stage displays. Software for the MicroBee and TRS-80 computers is included with the article.

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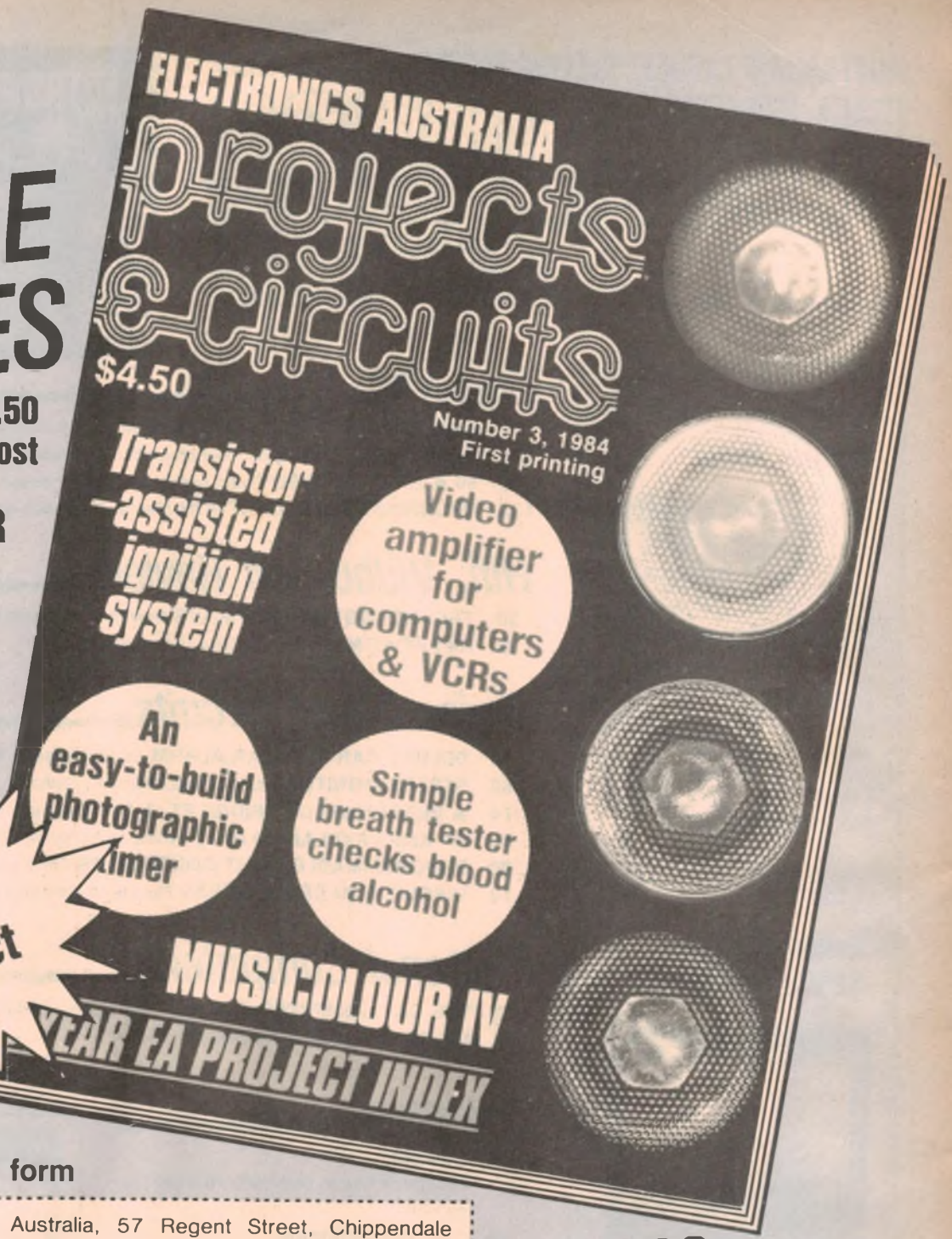

Contains 10-year EA Project Index

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20 TOP PROJECTS REPRINTED FROM ELECTRONICS AUSTRALIA

ELECTRONICS AUSTRALIA

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Circulation Office
Unit 3B, Sydneygate, Waterloo, 2018.
Phone (02) 699 2388.

Subscriptions
Subscription Dept, John Fairfax & Sons Ltd, GPO Box 506, Sydney 2001.
Enquiries: Phone (02) 699 2388.

Registered by Australia Post — publication No. NBP0240.
ISSN 0313-0150
*Recommended and maximum price only.

Editorial Viewpoint

Electronics is not a soft option

From time to time we have young readers writing to us for advise on how to pursue a career in electronics. We regard this as symptomatic of the times. In the past such advice was rarely asked for. The interested person did not need it and there were plenty of job opportunities in the electronics industry.

Now the situation has changed quite markedly. There are relatively few job opportunities in the electronics industry, at least as far as large manufacturing companies are concerned, and competition for those jobs is intense. In that respect, electronics is little different from most fields of endeavour.

The trouble is that by the time most people have left school the die is cast. They have either studied and passed well in subjects that will give them an entrance to electronics courses or they haven't. If they haven't, they may be able to retrieve the situation by several years of study at night school but that is not an attractive proposition.

For today's students the earlier they set themselves on a path to an electronics career the better. In fact, the path really has to be set from the day that they enter secondary school. And the subjects they must take are not the easy options. They must take higher level mathematics and the science subjects, physics and chemistry.

That the student must do well in these subjects is mandatory. And doing well merely gives you a chance to do a tertiary course, whether it be at certificate or degree level. It is a sad thing that this must be so but it is well to acknowledge the fact while the student is still at school when something can be done about it.

So to students who wish to prepare themselves for a career in electronics, start now. Aim to do well in mathematics and science subjects and forget the easy options. In the long run they are the hardest options of all.

Science subjects can be made more relevant

At the same time as advising students to take the hard options we must admit that these subjects could be made a lot more relevant and interesting to students. Unfortunately, mathematics and science subjects are often presented by teachers who have little or no idea of how their subjects are applied to modern technology.

For example, how many students being taught calculus and the equations for a parabola are told that the equation $y^2 = 4ax$ is the basis of headlight reflectors and microwave dish antennas and this equation is the only profile that will bring parallel rays to a single-point focus. I certainly was not, and it was not until years afterwards that I realised the significance of that equation. How much easier it would have been if I had known that.

And again, how many students are taught about induction coils without ever learning that the biggest and most important application of this basic science is in car ignition systems. This points to a basic lack of background knowledge of the teachers.

There is still too much teaching of mathematics in the dry and abstract sense which makes it hard for students. Teachers who can relate their subjects to everyday objects are doing their students a great service.

Leo Simpson

Printed by Magazine Printers Pty Ltd, Regent Street, Chippendale and Masterprint Pty Ltd, Dubbo, NSW for Magazine Promotions, Regent St, Chippendale.

Distribution: Distributed in NSW by Magazine Promotions, 57 Regent St, Chippendale, in Victoria by Magazine Promotions, 392 Little Collins Street, Melbourne; in South Australia by Magazine Promotions, 101-105 Waymouth St, Adelaide; in Western Australia by Magazine Promotions, 454 Murray Street, Perth; in Queensland by Gordon and Gotch (A'asia) Ltd; in Tasmania by Ingle Distributors, 93 Macquarie St, Hobart; in New Zealand by Gordon and Gotch (NZ) Ltd, Adelaide Rd, Wellington.

POST CATALOGUE BARGAINS

Like Noah's Ark some of our products didn't make our 1984 catalogue. Most did (but we have too much stock). We have to clear stocks to make way for brand new products! Grab the bargains now while they last!!

CONDUCTIVE PLASTIC BAGS

Manufacturer's distress stock - you Reap the Benefit!

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Each bag measures a generous 280 high x 205 wide. They will accommodate complete S-100 boards, RAM cards etc. You can store your precious ICs in them safely. (The bag would hold hundreds of ICs).
Quantities strictly limited. First in first served.
Cat. ZB-9990

1-4 BAGS $2.00
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10 Up BAGS $1.00
(each)

50% REDUCTION ON THIS PRICE FOR MAY ONLY

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SCOOP!

8" CEILING GRILLES

Will they ever be this cheap again?

Once again - a massive scoop purchase with a difference. We have purchased a very large quantity of 'reject' grilles. They are rejects because they have small flaws in the mouldings. Most people however cannot pick the flaws if allowed to examine the grille. Imagine what the flaws look like *9 feet up* on the ceiling! Naturally we are offering a massive saving over normal units which we also sell. Exactly the same units (sans flaws) have been sold throughout Australia in the 10's of 000's. The perfect ones sell for around $2.95 - at least one company sells them for well over $3.00.
Cat. AX-3560

FROM 99¢

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Sensitivity	98(dB/W)
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Total Flux	61,100 Maxwell
Flux Density	8,300 Gauss
Net Weight	1,540 grams

ONLY $29.95

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The Cheapest in the WORLD??

Well maybe, maybe not.
But we think - maybe! Quality production types.

Cat. No.	1-9	10-24	25-99	100-999	1000
PI-6507	40¢ (50¢)	30¢ (45¢)	25¢ (45¢)	20¢ (45¢)	15¢

Normal prices shown in brackets - check the savings!!

MICROBEE KEYBOARD

Full 60 key QWERTY Computer keyboard exactly the same type as has been used up to now with the famous MicroBee Computer. SPST keys. Complete with mounting plate, all key caps etc. Fully assembled - incredible value.
Cat. XA-5500

ONLY $29.95

MINI BREADBOARD

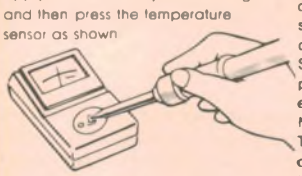
BARGAIN TIME

390 HOLES, perfect for small projects. Measures 80 x 60 mm. Several units can be made to lock together for larger breadboard configurations. Self-adhesive back.
NORMALLY $6.95
MAY ONLY $4.95 SAVE $2
Cat. PB-8808

SOLDERING IRON TEMPERATURE METER

EASY TO USE!

Apply solder to the tip of soldering iron and then press the temperature sensor as shown



ENGINEERS & OTHER PROFESSIONALS PLEASE NOTE! This compact, easy-to-read unit has a calibrated thermo-couple to accurately measure the temperature of your soldering iron. Most adjustable temperature controlled irons don't have a readout so you don't know what the temperature is! Simply allow your iron to reach temperature and touch it to a point on the front of the meter. The movement is sensitive enough to be driven direct from the thermocouple junctions. No batteries are needed and the meters should last forever. The scale is easy to read, calibrated in °C and also gives coloured bands to identify correct soldering temperature. It is a must for the professional who cannot afford bad solder joints or overheated boards (especially plated-thru PCB's)
Cat. QT-2100

ONLY $19.95
Quantities strictly limited!

NORMALLY $29.95
SAVE $10.00

DIGITAL DELAY LINE KIT

ONLY $449

$25 OFF
(this price)
MAY ONLY

The Digital Delay Line is designed to produce a huge variety of electronic effects. It works very well but the amazing thing is the low, low price! The effects depend on the time delay selected and some of those included are: Phasing, Flanging, Chorous, ADT (Automatic Double Tracking), Echo and Vibrato. The delay time can be varied from 0.32mS to 1.6 seconds! Because the signal is stored in digital form there is, unlike analog systems, no degeneration of the signal with time and unlimited repetition is provided by use of the freeze control. All the controls mount directly upon PCB's to eliminate wiring and to further simplify construction the main board is 'plated thru' i.e. there are no wire links or link through pins. The whole expanded 1.6 seconds model all fits on the main board as does the 400mS basic model. The cabinet which is free standing but also suitable for 19" rack mounting, is fully finished to a very high standard. The panel is deep blue whilst the cover is sprayed with a durable black enamel. The kit is available for only $424 - compare that with inferior units that can cost over $2,000!!
Cat. KJ-6621

COMPLETE 400MS VERSION

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AC adaptor to suit
Cat. MP-3010 $12.50

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GRAB ONE IN MAY AT A BARGAIN PRICE!

NORMALLY $3.95 - THIS MONTH $2.95
SAVE 25% - Cat. TH-2005

25% OFF

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We have discontinued the MPF-II Micro Professor Computer. At present we are holding substantial stocks of the MPF-II, Disc Drives, Software and other peripherals. If you are a MPF-II owner send a stamped addressed envelope for a list. Prices are up to 50% below our low normal prices on these products.

"JET PHONE" ADAPTOR - NEW

- IDEAL FOR AIR TRAVELLERS!!

How many times do you travel by air? If you are a regular traveller in economy, you will be undoubtedly familiar with the plastic 'pneumatic' type of stereo headphones. Well, we think that they are hopeless!!
They are uncomfortable (in our opinion) and unless you get a good fit, the sound quality is poor. Wouldn't it be nice to be able to use your OWN high quality headphones in flight?

NOW YOU CAN!!!

The Jaycar AA-2040 JET PHONE ADAPTOR plugs into the two air sockets on the armrest. You then plug your headphones into the adaptor for comfortable Hi Fi sound!!

BRILLIANT AND INEXPENSIVE!!

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As used in many kit projects. Will convert composite video to TV (VHF channel 0 or 1). Enables you to use your TV as a monitor.
Cat. LT-3900
ONLY $6.95

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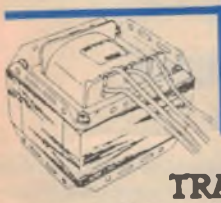
SIZE 1. 161(w)x96(d)x39(hf)x57(hr)mm
Cat. HB-6200 ..... ORANGE
Cat. HB-6201 ..... GREY
Cat. HB-6202 ..... BLUE
Cat. HB-6203 ..... BLACK
1-9 $6.95 ea 10 up $6.45 ea

SIZE 2. 215(w)x130(d)x47(hf)x73(hr)mm
Cat. HB-6210 ..... ORANGE
Cat. HB-6211 ..... GREY
Cat. HB-6212 ..... BLUE
Cat. HB-6213 ..... BLACK
1-9 $12.95 ea 10 up $11.95 ea

THE ABOVE PRICES LESS 40% - MAY ONLY

MICROBEE CARRY CASE

Ideal for mobile 'Bee users. Beautiful brown vinyl case with attractive MicroBee logo embossed on the front.
NORMALLY $12.50
$9.95 Cat. XA-5570
MAY ONLY



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As used in 300 watt amplifier kits. Back in stock. Genuine high-spec tranny. ★ Secondary 94V @ 3 amps (47-0-47) plus 2 x 15V @ 500mA

★ Primary 240V
Cat. MM-2017
NORMALLY $49.50 - MAY ONLY
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2708 EPROM - ARE WE CRAZY?

- You normally can't get them!!
- They normally sell for $7.95 from us (which is cheap)
- Limited Quantity
- Offer strictly limited

ONLY $4.95
Cat. ZZ-8450

240V CASSETTE HEAD DEMAGNETISER

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MAY ONLY $5.95 - SAVE $2.55
Cat. AC-1600

QUALITY "AIRPAX" DC CIRCUIT BREAKER

Unbelievable bargain. Quality Airpax U.S. made unit features large on/off rocker switch and snap-in panel mount capability.
SPECS.
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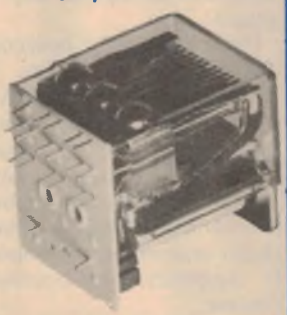
We were staggered by the demand for the ANRITSU 48V relays advertised earlier this year. They were an incredible bargain at 30¢ in quantities of 10. Some customers were buying hundreds at a time! Naturally we ran out. We are now pleased to advise that we have purchased another (smaller) batch. Unfortunately they cost us considerably more, but we feel that they are still a bargain!
Cat. SY-4015

1-9 $1.25 each
10 up 95¢ ea



SUBWOOFER CABINET

Quality vinyl look pre-cut cabinet. Complete with speaker clothe already mounted.
Cat. XA-1454

NORMALLY $79
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News Highlights

Dr Hellestrand shows the defibrillator before implantation in patient Patrick Gilmour.

Implantable defibrillator increases the odds for heart patients

Each year, around 30,000 Australians die suddenly from heart failure, caused either by a coronary occlusion (a heart attack) or a disturbance of the electrical rhythm which controls the beating of the heart. One method of treating heart rhythm disturbances is the implantable defibrillator similar to that received by New Zealander Mr Patrick Gilmour.

Patrick Gilmour suffered from ischaemic heart disease and coronary artery disease in which the arteries feeding the heart had narrowed and blocked blood supply through the heart. Prior to the operation to install the defibrillator his heart stopped 13 times and was restarted but he remained prone to ventricular fibrillation, a condition characterised by rapid, irregular heart action that leads to heart failure.

The implantable defibrillator was developed in the United States to restart the heart automatically. It consists of electrodes attached to a metal coil inside the heart on a 15cm flexible lead and another lead attached to a flat teflon patch on the exterior wall of the heart. Both leads are linked to electronics contained in an hermetically sealed titanium box sewn into the wall of the abdomen.

The device responds both to the heart rate and the profile of the electrocardiogram waveform detected by a pair of electrodes implanted in the heart. When an abnormal heart rhythm is detected a shock is sent through the heart within 15 seconds to restore the normal heart action.

Electrical activity, however, is only one determinant of heart function. Mr Gilmour's heart eventually failed to respond to the normal electrical rhythm produced by the heart itself. In the final event the electrical rhythm of his heart remained within normal bounds but the mechanical pumping action failed. His death underlined the importance of early diagnosis and treatment of heart disease.

According to Dr Kevin Hellestrand, one of the participants in the two hour operation to implant the defibrillator, the device itself has proved its usefulness. Of those revived after sudden heart failure caused by ventricular fibrillation, some 30 to 40% will die in the first year following the event. In the United States the defibrillator has reduced this to under 5%.

New kit supplier

Yet another company has emerged to serve the growing kit electronics market. The appropriately named "Kitronics" company is a Melbourne-based mail order house offering a range of projects to the kit constructor.

Managing Director Richard Stott says "We build a sample of every kit we carry, to ensure quality of components and completeness of the sample. This ensures that any shortcomings in quality or constructional methods are eliminated before they reach the customer. Nothing is more infuriating than trying to construct a kit with inferior components so when we build our samples we are constantly on the lookout for ways of improvement".

Kitronics kits are available from PO Box 126, Epping, Vic 3076 or by Bankcard phone order on (03) 439 3591 or (03) 435 0865 after hours.

Austpac adapted for Videotex

Following development work involving Melbourne company Computer Power, Telecom Australia and Elders IXL, Austpac has now been adapted to simplify use by videotex terminals.

The development will benefit the fledgling videotex industry in Australia as it enables the immediate establishment of national videotex networks at reasonable cost prior to the introduction of Telecom's Viatel gateway towards the end of this year.

Users of videotex terminals with simple numeric keypads can now originate calls through Austpac and access videotex host computers as easily and simply as by the present methods using the dial-up voice network.

The new facility – "Austpac – Access to Videotex Systems" was developed by Telecom with assistance from Computer Power and involves changes to Austpac Profile 9, which is now the default for 1200/75 bits per second access.

The changes were developed by Telecom using a Videotex terminal supplied by Visionhire, and the facility was finally tested by Elders IXL, who have 150 videotex terminals distributed throughout rural Australia. These terminals access a DEC VAX system in Melbourne, running Aregon IVS-3 videotex software, both supplied and managed by Computer Power.

The Elders IXL videotex system was the first and is currently the only videotex service in Australia using Austpac for ter-

David Hogg of Computer Power explains the Austpac system to Peter Beischer of Elders IXL farm information services.

minal access.

The ability of Videotex users to access remote computers via Austpac is a breakthrough in the development of cost effective videotex systems in Australia. Until this development, Elders IXL rural users had been accessing the Melbourne host via a rotary group of 008 INWATS lines, at a cost of $30 per terminal per hour. Computer Power have calculated that the cost for a typical videotex session using Austpac is approximately $8 per terminal per hour, a saving of 73% of current national INWATS charges where terminals are more than 50km distant from the host.

Volunteer radio station for visually handicapped

Radio station 3RPH Melbourne broadcasts from 8pm to 10.30pm on week nights with rebroadcast material from 10am to 12.30pm Tuesday to Saturday, specially for the blind and handicapped. The station is operated by two full time staff and around 150 volunteers who select material for reading over the air.

The program content covers news, feature and sports stories of special interest to the handicapped, and organisers are hoping to expand the service to operate from 7am to 10pm seven days a week. This would be possible by building the station volunteer staff to at least 75 people. Volunteers are sought to work just a few hours each week, preparing and reading items for broadcast.

3RPH can be heard on 1629kHz, just above the AM broadcast band.

Subscription TV by satellite under consideration

Proposals for the provision of Radiated Subscription Television (RSTV) services are currently being studied by the Government, although no decision has been made on whether such services will be permitted.

Once the Aussat satellites are launched in the second half of 1985, most Australians will be able to receive ABC television. A subscription service transmitted via satellite, however, might be the only way in which viewers in remote areas can receive additional television services, according to the Department of Communications.

Under such a scheme subscribers to RSTV would pay a monthly fee and receive transmissions over the air through a special decoder attached to their television sets. The government has decided that the three large eastern TV networks will not be allowed to direct broadcast, hence the RSTV proposal.

"Two of the major issues for the Government to consider when it looks at the RSTV proposals will be whether RSTV could boost Australian film and television production and also have an impact on the development of Australian technology," Mr Duffy, the Minister for Communications, said recently.

If RSTV went ahead, the providers of the service would have to pay an establishment fee plus a levy of 50c a month per subscriber. The levy would be paid into a special fund to encourage production of Australian films and television programs. "The fund guidelines will specify types of production which should be encouraged, for example drama and children's programs," Mr Duffy said.

In February the Government issued guidelines for RSTV proposals which specify that a certain minimum percentage of peak viewing time will be filled by Australian productions. No advertising will be permitted on RSTV services, and general television program standards will not apply – classifications for RSTV programs will be those of the Film Censorship Board, which are significantly broader than those applying to television programming.

Big response to supplementary broadcasting licence scheme

All 36 commercial television stations located outside mainland metropolitan cities or in Tasmania have formally expressed interest in obtaining an extra, or supplementary, licence, the Minister for Communications, Mr Michael Duffy, has announced. In addition, 86 of the 101 eligible radio stations have formally expressed an interest.

The Supplementary Licence Scheme officially began on 1 December 1983 to provide people living outside the mainland capital cities with a more diverse range of radio and television programs.

Under the scheme, existing commercial stations in country areas may apply for a licence to operate a second broadcasting service. However, the Government has stated that it would prefer the establishment of an extra independent service, and supplementary licences will not be issued to existing broadcasters if the Australian Broadcasting Tribunal finds that an independent service is commercially viable and in the public interest.

"This will ensure that wherever possible an extra independent commercial service is provided," Mr Duffy said. "The Government's aim is to increase diversity of choice in radio and television programming for people in regional areas, without promoting an over-concentration of media ownership in the area."

After applications have been accepted they will be directed to the Australian Broadcasting Tribunal which would if necessary schedule public hearings in the various areas. It is hoped that these will begin in the last quarter of this year.

Jones criticises "avoidance syndrome"

Scientists suffer from an "avoidance syndrome", said Mr Barry Jones, the Minister for Science and Technology, in an address to new science graduates at Sydney University. He spoke at length on the lack of involvement of scientists in many important areas, including politics and industry and said that he was concerned by the contrast between the "extraordinary growth in power and pervasiveness of products in the physical sciences and the slow, even retarded, social response".

Scientists have generally not been particularly helpful in raising community debate and understanding about the relationship between science and society, the Minister said, and have been "extraordinarily silent" in the debate about the future. He was particularly critical of the tendency to concentrate on immediate work without considering its long term implications.

Scientists also exhibit "avoidance syndrome" with commercial exploitation of scientific discovery, said the Minister. Australia has a poor record in transferring pure research into products and there is only a "slender bridge" between the research community and industrial managers.

Mr Jones outlined five areas for action to overcome the problem, including an increase in the numbers of tertiary graduates in all fields, action to bridge the gap between research and management sectors and the creation of stronger mechanisms for transferring new technologies to industry.

Red faces department

Due to a printer's error, most of the prices on the Jaycar advertisement, on page 10 of our April 1984 issue, were omitted. We apologise to Jaycar and to readers who may have been inconvenienced.

UHF Tuner cancelled

Due to a number of technical problems we have been forced to cancel our promised UHF tuner project. We were not prepared to feature a project which would not at least equal the performance of UHF TV receivers and which would have required a difficult adjustment and assembly procedure. We apologise to readers who were looking forward to the project.

New electronics labs for Sydney Tech.

The Electronics Division of the School of Applied Electricity has moved to a new location at Sydney Technical College. At a cost of $2 million, Building L has been refurbished to provide re-designed and re-equipped laboratories and classrooms. The new facilities provide support for over 900 enrolled students per annum.

Training is provided at Trade and Post Trade levels with several special courses also being offered. There are no fees charged for any of these courses, which are available day and night.

Retraining for persons experienced in electronics is available in a wide variety of subjects. Retraining courses are offered requiring four hours attendance per week for 18 weeks. Special courses are available in basic electronics, two way radio and electronic workshop practices, including printed circuit board techniques.

Various areas in electronics are provided for with courses in digital and microprocessor principles, electronic communications, television principles, sound reproduction, and electronic control principles. As can be seen from the photo above, the courses lay particular emphasis on practical work with the latest electronic equipment.

Courses are also held in other centres in New South Wales. For further information contact: Sydney, Mr K. Harris (02) 217 3400. Ext 3346; Newcastle, Mr J. Horsnell (049) 61 7367; Wollongong, Mr A. Gosnell (042) 29 0499.

ACTIVE ELECTRONICS

4 KING STREET SANDRINGHAM VICTORIA 3191 PH (03) 561 2103

MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER

7400

7400	.48
7402	.48
7403	.48
7404	.48
7406	.95
7407	.95
7408	.48
7410	.48
7411	.48
7414	.60
7416	.55
7417	.77
7420	.60
7421	.60
7425	.48
7426	.50
7427	.51
7430	.48
7432	.48
7437	.54
7438	.48
7440	.48
7451	.48
7454	.48
7472	.72
7473	.63
7474	.55
7475	.67
7476	.60
7483	.78
7485	.82
7486	.54
7489	4.50
7490	.67
7492	.66
7493	.70
7495	.75
7496	.96
7497	1.50
74107	.84
74123	.72
74125	.65
74154	1.82
74157	.65
74161	.88
74190	1.35
74191	.98
74365	1.20
74366	1.20
74367	1.20
74368	1.20

74LS00

74LS00	.58
74LS01	.48
74LS02	.48
74LS03	.46
74LS04	.48
74LS05	.48
74LS08	.50
74LS10	.46
74LS11	.46
74LS13	.42
74LS14	.65
74LS20	.42
74LS21	.43
74LS27	.46
74LS30	.50
74LS32	.58
74LS33	.42
74LS37	.60
74LS38	.48
74LS42	.67
74LS47	.72
74LS48	.98
74LS51	.48
74LS54	.48
74LS73	.60
74LS74	.72
74LS75	.77
74LS76	.72
74LS83	.78
74LS85	.84
74LS86	.53
74LS90	.72
74LS93	.72
74LS95	.75
74LS109	.74
74LS112	.64
74LS123	.95
74LS125	.67
74LS126	.72
74LS132	.78
74LS138	.82
74LS139	.82
74LS151	.75
74LS153	.72
74LS154	2.20
74LS156	.84
74LS157	.88
74LS160	.96
74LS161	.96
74LS163	.84
74LS164	.84
74LS165	.96
74LS173	.96
74LS175	.75
74LS190	1.30
74LS191	1.15
74LS192	.94
74LS193	.96
74LS194	.96
74LS195	.84
74LS221	.95
74LS240	1.50
74LS241	1.80
74LS244	1.80
74LS245	2.10
74LS251	.80
74LS253	.96
74LS257	.80
74LS258	.80
74LS259	1.80
74LS266	.80
74LS273	1.50
74LS279	.55
74LS283	1.10

74LS365	.75
74LS366	.90
74LS367	.65
74LS368	.65
74LS373	1.70
74LS374	1.70
74LS377	1.80
74LS390	1.10
74LS393	1.10
74LS629	5.50
74LS640	2.20
74LS670	1.70
81LS95	2.40
81LS97	2.40
81LS98	2.40

74F00

74F00	.79
74F02	.79
74F04	.79
74F08	.79
74F10	.98
74F11	.98
74F20	.88
74F32	.96
74F64	.96
74F74	.89
74F86	1.40
74F109	.99
74F138	1.80
74F139	1.90
74F151	1.90
74F153	1.80
74F157	1.90
74F158	1.90
74F175	2.90
74F181	4.50
74F182	3.00
74F189	7.00
74F190	4.20
74F191	4.20
74F194	2.60
74F241	3.50
74F243	4.20
74F244	3.72
74F251	2.35
74F253	2.00
74F257	2.40
74F258	2.40
74F352	2.38
74F353	2.40
74F373	4.20
74F374	4.20

74S00

74S00	.60
74S02	.72
74S03	.62
74S04	.60
74S05	.62
74S08	.60
74S10	.60
74S11	.65
74S20	.60
74S30	.72
74S32	.82
74S40	.90
74S51	.60
74S64	.66
74S74	.70
74S86	.85
74S112	1.10
74S132	.85
74S135	1.90
74S136	2.60
74S138	1.15
74S139	1.35
74S151	1.26
74S153	1.32
74S157	1.32
74S158	1.15
74S161	4.50
74S174	1.50
74S175	1.30
74S188	3.60
74S189	4.70
74S253	1.40
74S257	1.30
74S258	1.40
74S283	5.20
74S287	3.00
74S288	3.50
74S289	5.00

74C00

74C00	.60
74C02	.60
74C04	.60
74C08	.60
74C10	.58
74C14	.78
74C20	.60
74C30	.60
74C32	.58
74C42	2.00
74C48	1.65
74C73	.83
74C74	1.10
74C83	2.05
74C85	2.20
74C86	.60
74C89	5.50
74C90	1.75
74C93	1.80
74C95	1.60
74C107	1.20
74C150	5.50
74C151	4.20
74C154	5.40
74C157	3.10
74C160	1.80
74C161	1.50
74C163	1.50
74C164	2.00
74C165	2.00
74C173	1.50
74C174	1.50
74C175	1.50
74C192	1.70
74C193	1.50

74C195	1.65
74C221	2.55
74C240	3.10
74C244	2.90
74C373	3.60
74C374	3.20
74C914	2.20
74C920	7.50
74C922	5.40
74C923	7.20
74C925	7.80
74C926	7.90
74C927	7.20
74C928	9.00
74C941	2.50

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4000	.40
4001	.55
4002	.55
4006	.78
4007	.45
4008	.90
4009	.80
4010	.80
4011	.45
4012	.45
4013	.84
4014	.95
4015	1.10
4016	.60
4017	1.20
4018	.80
4019	.60
4020	1.40
4021	1.20
4022	1.00
4023	.50
4024	.95
4025	.60
4026	1.20
4027	.90
4028	.95
4029	1.20
4030	.60
4034	2.70
4035	1.10
4040	1.30
4042	.90
4043	1.10
4044	1.20
4046	1.50
4047	1.50
4048	.80
4049	1.00
4050	.70
4051	1.20
4053	1.50
4060	1.20
4066	.80
4068	.55
4069	.55
4070	.55
4071	.55
4073	.55
4075	.55
4076	.95
4077	.58
4081	.55
4082	.55
4093	.38
4411	15.00
4502	1.50
4503	1.00
4508	2.50
4510	1.20
4511	1.50
4512	1.50
4514	2.60
4515	1.95
4516	1.50
4518	1.50
4520	1.50
4521	2.60
4526	1.50
4527	1.70
4528	1.70
4538	1.50
4553	4.00
4569	2.70
4583	1.20
4584	.90
4585	1.05
9368	1.70
9370	3.40

LINEAR ETC.

ADC0800	19.50
ADC0804	5.50
ADC0808	15.00
AY-3-1015	6.50
AY-3 8910	10.00
BR1941	11.50
BR1943	12.00
CA3028	2.50
CA3039	2.10
CA3059	5.80
CA3081	1.50
CA3130	1.75
CA3130T	1.95
CA3140	.98
CA3140T	1.92
CA3146	2.70
CA3401	.99
DAC0800	3.95
DAC0808	4.50
DM8121	2.50
DM8130	5.20
DM8131	3.50
DS8869	1.80
DS75110	1.50
DS75150	1.80
DS75154	1.50
DS75451	1.10
DS75452	1.00
DS75453	1.00
DS75454	.66
FD1771	21.00
FD1791	37.00
FD1793	41.00

ICM7555	1.85
L120	3.50
L121	3.50
LF347	2.20
LF351	.65
LF353	1.40
LF356	1.65
LF357	2.60
LF398	4.80
LM10CH	6.50
LM307	.65
LM310	3.60
LM311-14	2.70
LM318	2.70
LM319	2.90
LM322	2.50
LM325	4.80
LM329	1.10
LM334	2.00
LM335Z	2.90
LM3362	1.80
LM349	2.16
LM358	.78
LM374	4.80
LM380-8	1.40
LM380 14	1.40
LM381	3.00
LM382	2.30
LM383	2.10
LM386	1.80
LM387	1.60
LM394CH	5.60
LM565	3.20
LM566	2.10
LM567	1.10
LM1830	3.20
LM2917-14	3.50
LM3080	1.30
LM3089	2.90
LM3900	.95
LM3905	2.00
LM3909	1.60
LM3911	2.00
LM3914	4.50
LM3915	4.50
LM3916	4.50
LM4250	2.90
MM5303	6.50
MM5837	3.50
MM58167	14.00
MN3001	13.90
MSM58372	15.00
NE530	2.30
NE558	2.30
NE571	2.80
NE5534	1.85
NE5534AN	2.60
OM321	12.00
OM350	9.30
SA80600	7.20
SN76477	7.50
SN76488	10.50
TL061	1.40
TL062	1.80
TL071	1.30
TL072	1.65
TL074	3.60
TL075	3.40
TL081	.60
TL082	1.30
TL084	2.70
TMS6012	7.10
TR1863	6.70
TR1983	10.00
UA301	.65
UA301H	1.70
UA308	.77
UA311	.89
UA311H	1.50
UA324	.90
UA339	.82
UA348	1.40
UA393	.75
UA555	.55
UA556	1.20
UA710	.75
UA711	.90
UA723	.66
UA723H	1.20
UA725	2.90
UA739	1.20
UA741	.55
UA741H	1.15
UA747	1.40
UA1458	.55
UA1488	.96
UA1489	.96
UA2901	.96
UA3086	.75
UA4136	1.70
UAA180	4.30
ULN2003	1.45
WD1393	64.00
WD1691	17.50
XR2206	5.95
XR2207	5.28
XR2208	4.00
XR2211	6.80
XR2216	2.80
XR2240	3.00
XR2243	2.90
8T26	2.70
8T28	2.80
8T95	2.20
8T96	2.30
8T97	2.30
11C90	14.00
95H90	14.50

MICRO

2102	5.00
2112	8.50
2114	2.80
2532	10.20
2708	5.90
2716	4.40
27128	43.00
2732	6.95

2764	11.40
4116 150NS	3.50
4164 150NS	9.80
6116P3	9.90
6502	10.20
6502A	10.70
6520	4.20
6522	9.00
6522A	11.70
6532	11.80
6545	21.00
6551	17.00
6800	6.70
6802	9.60
6809	14.50
6810	4.20
6820	4.20
6821	3.70
6840	6.60
6844	15.50
6845	14.00
6850	3.50
6852	4.20
6854	10.30
6875	12.00
68B00	9.80
68B21	4.90
68B40	10.50
68B45	17.50
68B50	4.90
68B54	17.00
8080	6.90
8085A	10.90
8155	9.50
8202A	59.00
8203	65.00
8212	3.80
8214	9.50
8216	3.70
8224	4.90
8226	3.70
8228	8.90
8243	9.00
8251A	8.90
8253	6.50
8255A	6.20
8257	12.00
8259	11.00
Z80CPU	5.15
Z80ACPU	5.80
Z80BCPU	11.20
Z80P10	5.15
Z80AP10	5.60
Z80S10	14.50
Z80AS10	15.00
Z80C1C	5.15
Z80ACTC	6.40
Z80DMA	14.60
Z80ADMA	16.00
8741A	39.00
8748-8	35.00
8749	54.00
8755A	39.00

VOLT REGS

LM337T	2.34
LM337K	6.80
LM338K	8.80
LM350K	6.30
LM350T	4.50
LM396K	18.90
LM79L05	.70
LM79L12	.72
LM79L15	.72
SH1605	19.80
UA317T	1.45
UA317K	4.25
UA309K	2.10
UA494	5.00
UA7805	.95
UA7805K	2.16
UA7806	1.00
UA7808	.90
UA7808K	2.40
UA7812	.94
UA7812K	2.50
UA7815	.90
UA7815K	2.40
UA7818	.90
UA7818K	2.40
UA7824	.90
UA7824K	2.40
UA78H05K	8.95
UA78H12K	9.90
UA78HGKC	10.80
UA78L05	.60
UA78L12	.60
UA78L15	.60
UA78P05K	15.70
UA78S40	3.50
UA7905	.95
UA7905K	2.35
UA7908	.96
UA7908K	2.40
UA7912	1.20
UA7912K	2.40
UA7915	1.30
UA7915K	2.40

OPTO

4N25	1.20
4N26	1.20
4N28	1.20
4N32	1.40
4N33	1.50
4N35	1.80
MCT6	1.90
MCT2	1.50
FND500	1.98
FND507	1.80
FND800	4.00
BPW50	2.00
CQY89	.85
MOC3020	3.10
MOC3021	3.10
MAN72A	1.70
MAN74A	1.70
FPT100B	3.40

LEDS

3mm GREEN	.15
3mm RED	.09
3mm YELLOW	.15
5mm GREEN	.15
5mm RED	.09
5mm YELLOW	.15
RECT. RED	.25
RECT. GREEN	.25
RECT. YELLOW	.25

DIODES

IN4148	.04
IN914	.04
IN4002	.08
IN4004	.09
IN4007	.12
IN5404	.28
IN5408	.30
OA47	.43
OA90	.17
P600G	
6A400V	.35
OA91	.30
OA95	.32

BRIDGES

VJ448	
10A400V	2.16
BR154	
15A400V	3.40
BR254	
25A400V	3.80
BR354	
35A400V	4.30
P04	
6A400V	1.50
RS204	
2A400V INLINE	.96
SB204	
2A400V	.75
W04	
1.5A400V	.50

ZENERS

5.1V 1 WATT	.22
5.6V 1 WATT	.22
6.8V 1 WATT	.22
10V 1 WATT	.22
12V 1 WATT	.22
12V 5 WATT	.75
75V 1.3 WATT	.90

TRANSISTORS

AC127	.70
AC128	1.20
AC187	.90
AC188	1.60
AD149	2.70
AD161	2.40
AD162	2.40
BC107	.40
BC108	.40
BC109	.40
BC177	.34
BC178	.34
BC179	.34
BC327	.29
BC328	.29
BC546	.20
BC547	.20
BC548	.20
BC549	.20
BC556	.20
BC557	.20
BC558	.20
BC559	.20
BC637	.45
BC639	.40
BC640	.40
BCY71	.80
BD139	.55
BD140	.55
BD233	.60
BD237	.60
BDV64B	2.80
BDV65B	2.80
BF115	.70
BF167	.75
BF173	.70
BF180	1.10
BF184	.80
BF198	.22
BF199	.22
BF337	.86
BF458	.72
BF459	.87
BF463	.97
BF470	1.20
BFY90	1.20
BU126	2.90
BU208	3.50
BU326A	2.90
BUX80	4.60
MFE121	2.00
MFE131	2.00
MJ802	6.50
MJ15003	5.20
MJ15004	5.20
MJ2955	1.65
MJ4032	9.50
MJ4035	11.20
MJ4502	5.20
MJE340	.80
MJE350	1.30
MJE700	.70
MJE800	.70
MJE2955	2.20
MJE3055	2.20

MPSA05	.22
MPSA06	.22
MPSA14	.24
MPSA56	.21
MPF102	.60
MRF901	3.20
TIP31C	.60
TIP32C	.75
TIP41C	1.10
TIP42C	1.25
TIP120	.84
TIP122	.90
TIP125	1.20
TIP2955	1.90
TIP3055	1.60
2N301	4.50
2N2219A	.60
2N2222A	.60
2N2646	.96
2N2647	2.60
2N2904	.73
2N2905A	.73
2N2906	.73
2N2907A	.60
2N3019	.70
2N3053	.65
2N3054	2.20
2N3055	1.30
2N3440	1.20
2N3441	2.60
2N3566	.20
2N3567	.20
2N3569	.20
2N3640	.20
2N3641	.20
2N3642	.20
2N3643	.20
2N3644	.20
2N3646	.20
2N3704	.25
2N3771	5.00
2N3773	5.50
2N3819	.80
2N3866	1.26
2N3904	.24
2N3906	.24
2N4032	.77
2N4033	.84
2N4250	.22
2N4355	.26
2N4356	.26
2N4360	.80
2N4401	.30
2N4402	.30
2N4403	.30
2N4416	1.40
2N5088	.20
2N5089	.24
2N5179	1.60
2N5190	.90
2N5191	.90
2N5192	1.00
2N5193	.90
2N5195	.90
2N5245	.90
2N5303	4.70
2N5401	.40
2N5457	.80
2N5458	.80
2N5459	.80
2N5461	1.20
2N5485	.80
2N5486	.90
2N5590	16.50
2N5591	18.50
2N5770	.25
2N5777	1.30
2N5944	15.00
2N5946	19.50

2N6027	.80
2N6084	22.00
2N6121	.90
2N6123	.90
2N6125	.90
2N6126	.90
2N6129	1.50
2N6130	1.90
2SC1061	.80
2SD350A	5.00
2SJ49	6.50
2SK134	6.50

SCR & TRIACS

C103D	.85
C106D	.96
C122D	1.80
C122E	2.30
C230D	6.80
SC141D	1.40
SC146D	1.95
SC151D	2.85
ST4	.60

TANTALUM

1UF/35V	.25
2.2UF/35V	.29
3.3UF/35V	.29
4.7UF/35V	.29
1UF/35V	.29
1.5UF/35V	.32
2.2UF/35V	.34
3.3UF/35V	.78
4.7UF/35V	.60
10UF/35V	.80

ELECTRO PCB

1UF/50V	.15
2.2UF/25V	.15
4.7UF/25V	.15
10UF/25V	.15
33UF/25V	.15
47UF/25V	.15
100UF/25V	.20
220UF/25V	.27
330UF/25V	.40
470UF/25V	.50
1000UF/16V	.45
1000UF/25V	.60
2200UF/25V	1.20

ELECTRO AXIAL

47UF/63V	.20
1UF/63V	.20
2.2UF/63V	.20
3.3UF/25V	.20
4.7UF/25V	.22
10UF/16V	.24
10UF/25V	.26
10UF/63V	.28
22UF/25V	.27
22UF/63V	.29
47UF/16V	.26
47UF/25V	.30
47UF/63V	.34
100UF/25V	.36
100UF/63V	.40
220UF/16V	.30
220UF/25V	.40
220UF/63V	.60
470UF/16V	.50
470UF/25V	.55
470UF/63V	.80
1000UF/16V	.65
1000UF/25V	.85
1000UF/35V	1.00
2500UF/16V	1.20
2500UF/25V	1.50
2500UF/35V	1.90
2500UF/50V	2.60
4700UF/35V	3.60

ELECTRO METAL CAN

2500UF/80V	3.50
4000UF/75V	6.50
5600UF/40V	4.50
8000UF/75V	9.00

ELECTRO BIPOLAR

2.2UF/50V	.35
4.7UF/50V	.38
6.8UF/50V	.39
10UF/50V	.40
22UF/50V	.46

GREENCAPS

.001UF/100V	.09
.0015UF/100V	.09
.0022UF/100V	.09
.0033UF/100V	.09
.0039UF/100V	.09
.0047UF/100V	.09
.0056UF/100V	.09
.0068UF/100V	.09
.0082UF/100V	.09
.01UF/100V	.09
.015UF/100V	.12
.022UF/100V	.12
.033UF/100V	.13
.039UF/100V	.13
.047UF/100V	.15
.056UF/100V	.16
.068UF/100V	.18
.082UF/100V	.18
.1UF/100V	.25
.15UF/100V	.26
.22UF/100V	.33
.27UF/100V	.34
.33UF/100V	.40
.47UF/100V	.72
1UF/250V	1.14
2.2UF/250V	2.10
3.3UF/250V	3.40
4.7UF/250V	2.80
6.8UF/250V	4.40
10UF/250V	5.90

GREENCAPS HIGH VOLTAGE

.01UF/630V	.27
.022UF/630V	.27
.033UF/630V	.27
.047UF/630V	.30
.1UF/630V	.56
.22UF/630V	.78
.33UF/630V	.98
.47UF/630V	1.30

CERAMIC

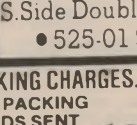
1 PF	.08
1.5PF	.08
2.2PF	.08
2.7PF	.08
3.3PF	.08
3.9PF	.08
4.7PF	.08
5.6PF	.08
6.8PF	.08
8.2PF	.08
10PF	.08
12PF	.08

STYROSEAL

56PF/630V	.25
68PF/630V	.25
82PF/630V	.25
100PF/630V	.25
120PF/630V	.25
150PF/630V	.25
180PF/630V	.25
220PF/630V	.25

* PRICES CORRECT AT TIME OF PUBLICATION BUT SUBJECT TO CHANGE WITHOUT NOTICE.

BANKCARD VIA YOUR PHONE



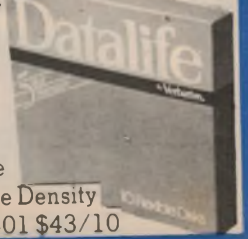
* NOW YOU CAN BUY YOURSELF COMPONENTS AT PRICES WELL BELOW THE NORMAL RETAIL PRICES. TO SAVE YOURSELF MONEY. SEND YOUR ORDER TODAY.

ALL COMPONENTS ARE FULL SPEC BY LEADING MANUFACTURERS

ALL PRICES INCLUDE SALES TAX.

5¼" SOFT SECTORED

S.Side Double Density
• 525-01 $36/10



D.Side Double Density
• 550-01 $43/10

POST AND PACKING CHARGES.

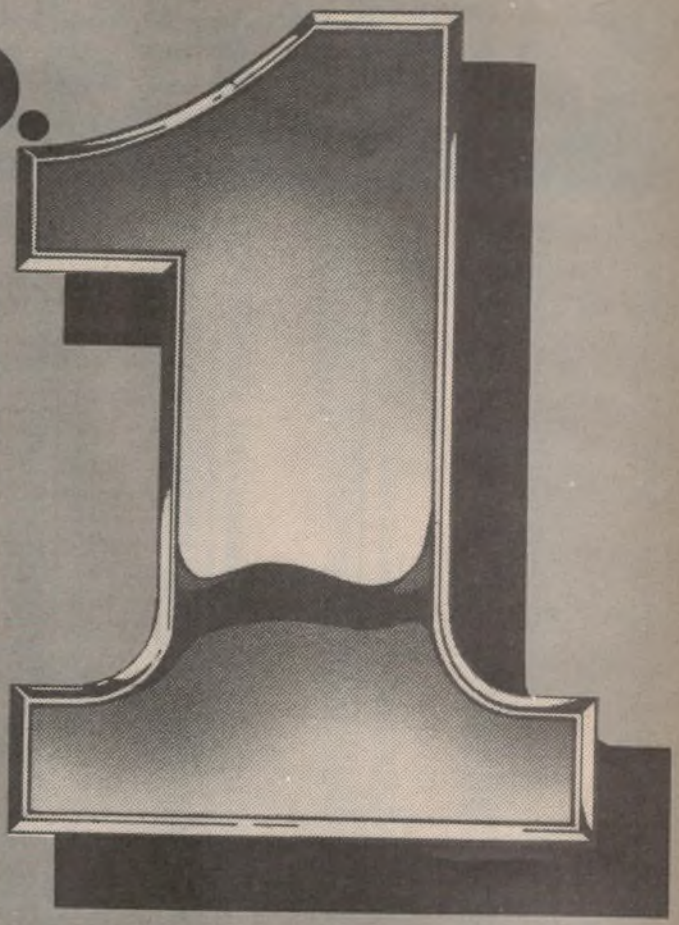
POST AND PACKING FOR GOODS SENT BY STANDARD MAIL IN AUSTRALIA ONLY

$3 $3

MAIL ORDER ONLY
(NO SHOP SALES)

MAIL ORDER MAIL ORDER MAIL ORDER

We're No.



NOW IN STOCK!

ARRL RADIO HANDBOOK '84

This amazing book seems to get bigger each year! This volume contains new projects for 160m, VHF power supplies and lots more!

Cat B-2219 **$19.95**

DICK SMITH'S Semiconductor Data Book

This book contains information on a variety of commonly used devices.

ONLY $7.95 Cat B-4200

Magazine File

Magazines are too expensive to throw out. Keep them for later reference with our deluxe binders. Fits EA, ETI, AR, ARA, Your Computer.

Cat B-4045 **ONLY $4.50**

Transmitting Valves

Type No.	Cat No.	Price
6146B	D-7202	$24.95
6JS6C	D-7204	$15.95

18V 14A Transformer

Massive 18V at 14A continuous . . . ideal for high rating power supplies. Suits 13.8V 25A pk supplies.

ONLY $49.95 Cat M-2010

Cooling Fans

Getting a bit hot under the collar? Use one of these superb rotary fans: FANtastic for any device that needs forced air cooling. Can be mounted to suck or blow.

Rotary Fan

120 x 120 x 40 mm deep, with mounting holes on 75 mm radius.

Cat Y-8500 **ONLY $19.95**

Mini Fan NEW!

80 x 80 x 25 mm deep. Mounting holes on 51 mm radius.

Cat Y-8505 **ONLY $19.95** Includes finger guard

NEW!

Daisywheel Printer/Typewriter

This typewriter can be connected to your computer as a printer. Prints at 13 cps, choice of 3 pitches, impression control, auto correcting, full tabs and margin settings. Centronics-type interface.

Cat X-3275 **$895**

COMING SOON!

Multimeter with audible continuity tester

A compact, reliable multimeter with an added bonus: a built-in buzzer for continuity testing! Also has a battery checker PLUS 10A DC range! High sensitivity (20,000 ohms per volt), meter mirrored scale and large banana plugs for sure contact.

Cat Q-1022 **$29.50**

Multimeter & Logic Tester

This is the very first analog multimeter ever with its own built-in Logic Tester! Built-in LED's give instant recognition of 'HIGH', 'LOW' and 'PULSE' states of logic circuits. 18 voltage, current and resistance ranges, with 20K ohm/V sensitivity DC and 8K ohm/V AC. Complete with instructions, batteries and probes.

Cat Q-1026 **$32.50**

Inductive pick-up

Suction cap sticks so no electrical connection needed. Ideal for amplifiers, tapes, etc (recording of phone conversations may not be permissible).

Cat C-7300 **ONLY $1.80**

Xidex quality diskettes

Don't risk loss of valuable computer data by using 'economy' floppy disks – they could cost you a fortune! The new Xidex range of Precision disks offer a level of quality and reliability previously unknown.

NEW!

Single sided, double density HARD sector Cat X-3505 $4.95
Single sided, double density SOFT sector Cat X-3510 $4.95
Box of 10 Single sided, double density SOFT/s Cat X-3512 $54.50

IT'S THE AMAZING BICYCLE COMPUTER!

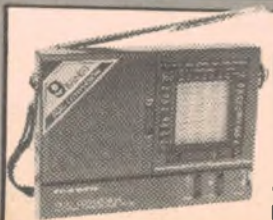
Add a bike computer to your pushbike and you'll really know how well you're doing. Very simple to fit on all types of pushbikes, displays distance, speed, elapsed time, average speed etc. Cat Y-3010

$49.50

10A 240V Microswitch

SPDT contacts, 240V DC 10A rating. Ideal for use in burglar alarms, limit switches, etc.

Cat S-1920 **$1.95**



For the short wave listener!

MW/FM/SW 9 BAND

Tune into the world with this 9-band receiver. Features tone switch, LED tuning indicator, telescopic antenna, earphone jack and built-in prop stand. Includes earphone, external antenna wire, protective case and full instructions.

Cat D-2837 **$119**

BATTERY OPERATED

for the hobbyist . . .

It's a steal! Dick Smith Wizzard at cost!

Our loss is your gain! We're overstocked with the amazing Dick Smith WIZZARD and must clear excess stock. Hurry! Take advantage of our problems. Stocks strictly limited – Don't miss this amazing ½ price offer.

WAS ~~$295~~

$139

Cat Y-1600

WHILE STOCKS LAST!

LED's, LED's Premium Quality!

Matched brightness, top quality. For those projects whose appearance really matters.

Colour	Size	Cat No.	Price	10 up
Red	3mm	Z-4077	30¢	25¢
Green	3mm	Z-4079	35¢	30¢
Yellow	3mm	Z-4081	50¢	45¢
Orange	3mm	Z-4083	50¢	45¢
Red	5mm	Z-4085	30¢	25¢
Green	5mm	Z-4087	35¢	30¢
Yellow	5mm	Z-4089	40¢	35¢
Orange	5mm	Z-4091	40¢	35¢

Red High Intensity Cat Z-4075 95/90¢

It's Alarming!

Horn Speaker

All-weather horn speaker with plastic body for long life. 8 ohms impedance. 10 watts rating.

Cat C-2705 **$10.25**

Reflex Horn

Larger horn with huge rating. For installations where a loud alarm is a must.

Cat C-2718 **$26.50**

Fire Bell

Huge 8 inch bell with massive gonger, 12 volts operated at 300mA

Cat L-5280 **$34.95**

Window Foil

Adhesive backed aluminium foil for window and door glass 6.5mm x 32m roll.

$6.95

Cat L-5200

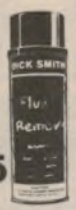
Reed switch/magnet set

In plastic cases, ideal for aluminium windows; includes mounting holes and screw terminals for wires.

$2.75

Cat L-5210

NEW! Flux Remover



Fantastic for service work technicians and for cleaning up messy solder jobs! 400g spray can **$7.95**

Cat N-1055

Soldering Stand with Magnifier NEW!

Heavy base, adjustable clips, solder stand. ONLY **$9.95**

Cat T-5710

Infra red beam relay

240V powered, with a 12V DC @ 1A output each time the beam is broken. Can be set for 'instant' and 'intermittent' (outputs five secs. after beam is broken).

Cat L-5050

GREAT VALUE! ONLY **$99**

Low Cost Soldering Iron

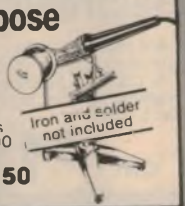
A general purpose iron that gives 25 watts of heat very quickly. Stainless steel barrel and copper tip.

$9.95 Cat T-1330

Spare tip to suit, T-1312 $2.75

Multi-purpose stand

Adjustable vice, iron holder and spool holder. Leaves both hands free! Cat T-5700



ONLY **$29.50**

Microwave Alarm detector

Invisible microwaves detect any movement in the target area. Works through fibro, plaster, etc.

ONLY **$95**

Cat L-5000

NEW! Arlec Supertool

Don't buy an ordinary PCB drill: take a look at the new Arlec Supertool. It polishes, cuts, grinds, engraves, sands, mills & drills!

Inc. mains adaptor

$39.95

Cat T-4754

Spare Parts

Drill bits T-4756	$4.95
Grinding bits T-4758	$5.95
Ink Erasers T4760	$2.95
Pencil Erasers T-4762	$2.95

Digital LCD Multimeter BARGAIN!!!

What a special! Fantastic quality LCD digital multimeter with single knob selection (no messy lead swapping!) at a truly bargain price. Huge 10A AC & DC capacity, high impedance and 25 ranges. Normally great value . . . now fantastadicksagoriferous!

WAS ~~$79.95~~

This month **$49.95**

Hurry . . . limited stock

Cat Q 1455

Miss out on your Dick Smith Electronics catalogue?

How can you last the rest of the year without it. Rush – do not dawdle – to your nearest Dick Smith Electronics store and they'll swap a brand new, bright shiny Dick Smith Catalogue for one of your old, worn out $1 notes.

And you'll even get the $1.00 value back again with our $1.00 bonus coupon!

There's a store near you – or use our reliable home delivery service

Terms available to approved applicants through . . . HFC

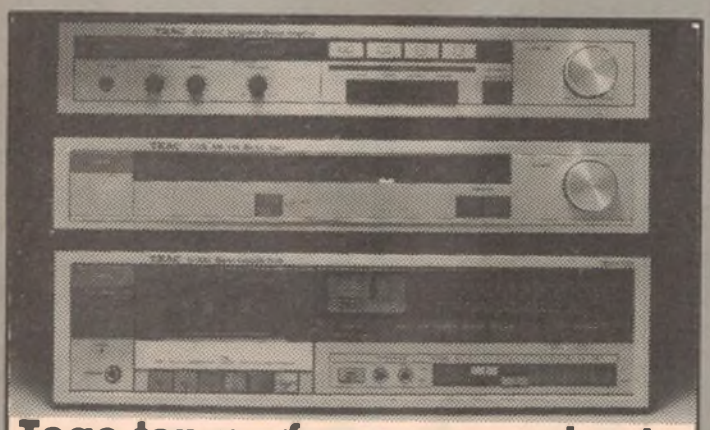
bankcard welcome here

DICK SMITH ELECTRONICS

See page 98 for address details

DSE A 741/KT

..and No.



Teac top performance system!

Teac A-313: 22W/Ch Integrated Amplifier

Superb quality in a modern-as-tomorrow hi fidelity amplifier. DC coupled for optimum noise and distortion characteristics; 22 watts/channel rating. Suitable for two sets of speakers with A/B/AB switching. Cat A-1310

Teac T-515: AM/FM Stereo Tuner

The perfect match for the A-313. With superb styling the T-515 is delightfully simple to operate, and even has a built-in recording calibration tone! 'Made for Australia' model with correct Australian FM band (not wrong overseas band!) Cat A-1510

Teac V-300: Stereo Cassette

And to complete the trio– a superb 'metal' compatable stereo cassette deck with soft-touch controls and large LED peak level meters. Plus features not normally found in the V-300 price range: direct function mechanism, brilliance switch, Dolby B noise reduction, record mute function, independent l/r record level controls and much more!
Cat A-3507

SPECIAL OFFER
Buy above three units & get the superb Dick Smith Belt Drive Turntable for only $12 extra! $AVE $AVE $AVE!

NORMALLY $856
SYSTEM PRICE
$699

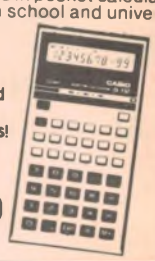
Electronic Buzzer

Solid state warning, operates from 4–15V DC. Tiny (32 x 14.5mm) with massive 70dB@ 1m output.
Cat L-7009

ONLY **$1.95**

Casio FX-550 Calculator

Superb, new calculator from one of the world's leading manufacturers, with features you'd expect to pay $$$ more for, like 10 digit LCD, 8 digit mantissa & 2 digit exponent, memory and lots more. The last word in pocket calculators, ideal for high school and university students.
Cat Q-3100



Recommended by many leading schools!
ONLY
$42.50

Buy your components the smart way

BULK PACKS

Resistor pack **$5.90**
300 computer selected ¼W types, 60 values, 5% types. Cat R-7010 — worth $12

Metal Film Resistors
300 precision 1% ¼W metal film resistors. **$13.95**
Cat R-7015 — $18 worth

Greencap Pack **$8.95**
60 greencaps. 100 volt rating, selected values of .001uF-0.22uF.
Cat R-7040 **$13 value**

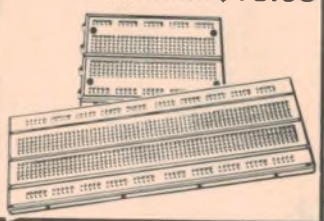
Electrolytic Pack **$6.75**
55 single ended electros, 2.2 to 470uF, voltages form 10 to 25.
Cat R-7030 — $13 worth

Ceramic Pack **$4.75**
Over 60 quality ceramics, none less than 50VW, some as high as 630VW. Selection of range from 10pF to 0.1uF. Cat R-7050 — $7 value

Prototype Boards

No more rats nests! The easy way to build up circuits.

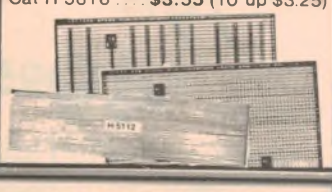
Mini board (size 80x60x8mm)
Cat P-4614 ..... **$9.20**
Giant board (size 175x67x8mm)
Cat P-4615 ..... **$13.95**



Printed Strip boards

The most versatile board of the lot! Etched copper strips are predrilled and plated ready for solder.

2.54mm spacing x 76 mm x 153mm
Cat H-5612 .... **$3.15** (10 up $2.90)
2.54mm spacing x 76mm x 76mm
Cat H-5614 .... **$1.65** (10 up $1.55)
2.54mm spacing x 76mm x 153mm
As H-5612 board, but with pre-cut short tracks making it ideal for multi IC work. Plated strips.
Cat H-5616 .... **$3.55** (10 up $3.25)



Stackable
Parts Drawers

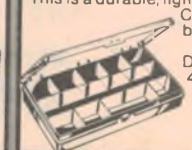
Somewhere to keep all those bits and pieces. Stackable, too: very handy! Two styles:
One drawer per box **$3.15**
Cat H-2584
Two drawers per box
Cat H-2585
$3.15

Dick Smith ZIPPY BOXES

Small–UB5(28x54x83mm) Cat H-2755 ..... **$1.80** (10 up $1.60)
Medium–UB3 (41x68x130mm) Cat H-2753 ..... **$2.25** (10 up $2.05)
Large–UB1 (50x90x150mm) Cat H-2751 ..... **$2.80** (10 up $2.55)
Giant–UB2 (60x113x196mm) Cat H-2752 ..... **$3.99** (10 up $3.50)

Adjustable Utility Box

This is a durable, lightweight utility box. Compartments can be adjusted to suit your own needs. Dimensions: 285 x 40(h) x 170(d)mm.
Cat H-2592
$6.75



for kits & bits!

Project Case

A superb case ideal for a large range of projects. Features removable front & rear panels. easy PCB mounting. Size 210x175x55mm

Cat H-2520
$12.50
(10 up $11.50)

Multi-output Solar Cell!

NEW!

21st century power!
Encapsulated cell giving 3, 6 or 9V out at 50mA. Great for solar powered projects etc. complete with reflectors. Cat Z-4842

ONLY $29.95

19in Rack Mounting Case

Quality black instrument case fits standard 19in racks. Heavy gauge (3mm) front panel, Size 42.5 x 25 x 14cm.

Cat H-2481
$49.95

SAVE $70 ON MIGHTY BEARCAT 20/20

Our most popular scanner ever!

Yes! Famous Bearcat 20/20 scanner-the one with the lot including dual power, aircraft band, etc - now reduced by an amazing $70! Hurry: limited stock. Don't miss it!

was $499
NOW ONLY $429

Cat D-2810

Go anwhere with the FT-290R all mode

And save a bundle! Normally great value at $429 . . . now our most popular Yaesu 2m set is even better at $399! All mode, portable/mobile/base set goes where you go. A bargain!

was $429 Now only $399

Cat D-2885

KIT

The Amazing Stereo Simulator II

Wish those old video movies had modern stereo sound? This low-cost gadget turns almost any mono signal into amazingly good synthetic stereo!

Cat K-4321

ONLY $19.95

KIT

Fluoro Starter

Gives tubes a longer life!

This substitute electronic starter gives you a smooth rapid start EVERY time you switch on. Housed in an old starter case! Outlast coventional starters.

Cat K-3082 ONLY $4.50

KIT

Car Alarm Mk2

Protect your cat the easy, low cost way with this great kit. Simple to construct & fit; compare the cost with built-up alarms.

Cat K-3253

ONLY $22.50

Includes die cast case, terminal block & Alarm sticker.

KIT

Motor speed control

The latest in speed controller circuits, designed to eliminate all the problems of earlier types.

Cat K-3081

ONLY $22.50

KIT

Microwave Leakage Detector

Microwave ovens are fantastic — but are they completely safe? Yours could be leaking dangerous radiation! Check it out with this handy meter. Needs no batteries.

Cat K-3095

ONLY $13.95

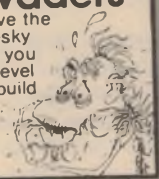
KIT

New! Build your own Alien Invaders

Wow! You could save the earth from those pesky aliens. . .and on a kit you built yourself! Multi-level LED display, easy to build & battery operated.

Cat K-3393

$15.95



KIT

NEW! LET CALLER

Anyone for tennis?

When you play McEnroe, he won't be able to dispute any calls!
Portable, battery operated - use on any court with wire rope for net.

Cat K-3089
ONLY $19.95

KIT

Now you can be heard! Loud Hailer

A great kit for the kids - their own loud-hailer! Exclusive detachable horn for minimising feedback, battery holder/handle, amplifier and mic module, it's so easy to build and it really works well! Horn can be remotely connected too.

Cat K-3507

TOP VALUE

$29.95

KIT

The not so random Breath Tester

Beware boys in blue and booze buses bailing belligerent Barbhams blowing bad breath into bags before banning. Check out our breath tester kit - it could be the answer to your broblems! Cat K-3391

NOT LEGAL CHECK

ONLY $29.95

KIT

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Sydney's traffic

Have you ever stopped to think how traffic lights are controlled in a city like Sydney? Most of us regard traffic lights as a nuisance, yet an effective traffic light system is essential in any large city.

by PHILIP WATSON

At some time or other we have all muttered rude words when halted at a red light while running late for that all-important date or business meeting. But the real enemy is not the traffic light; it is the opposing traffic which is demanding its share of the intersection. And remember, when you get a green light it is normally at the expense of someone else being held by a red light.

The problem of cross traffic at intersections is nothing new. Ever since there have been wheeled vehicles in large cities there has been this potential conflict. Apart from various rules or conventions – major and minor roads, give way to the right, etc – the most effective solution in the past has been the constable on point duty. Unfortunately, while effective, it is also very expensive – so much so that it becomes quite impractical to man every intersection in a moderate size city, and certainly not in one as large as Sydney.

To make matters worse, Sydney has its own special problems. There was very little early planning of the road system, it is hilly and it has an irregular waterfront to contend with, all of which adds up to an erratic road pattern with many curves and bends.

But, apart from special problems, every large city in the world faces the same problem; how to move vast numbers of vehicles into and out of the city in the morning and evening, and through it during the day, with minimum delay and conflict.

Virtually every city has tackled the problem in the same broad manner; by installing various forms of automatic traffic light systems. Depending on the traffic density and the complexity of the road pattern, they are successful to a greater of lesser degree.

Early systems

The very earliest traffic light systems, in the USA and Great Britain, worked on a fixed time cycle basis, allocating a pre-determined time period for each cross street. Such systems had limitations, not the least of which was the situation where a driver found himself confronted by a red light when there was no cross traffic in sight, and had to sit and wait for the timer to complete its cycle.

The next approach was the vehicle actuated system, using mechanical or pneumatic actuators to sense the presence of a vehicle wishing to enter the intersection. Such systems have the advantage that they can be designed to sense the rate of traffic flow in each direction and modify the timing cycle to favour the heavier traffic flow. Also, during slack periods (late at night) they can respond rapidly to a vehicle's presence, in the absence of cross traffic.

The first traffic signals in Sydney were of the vehicle actuated type. They were installed at the intersection of Market and Kent streets and commissioned on 13 october, 1933. They were, in fact, only on trial and were not officially accepted from the suppliers until after a three month trial period.

Four more sets of signals were installed in 1937 at York and Margaret Streets, City; Clarence and Erskine Streets, City; Pyrmont Bridge Road and Booth Street, Camperdown; and Pyrmont Bridge Road, Wattle Crescent, and Jones Street, Forrest Lodge. From then on installations proceeded at an ever increasing rate. The 1000th set was installed in 1974 at Pittwater and Warringah Roads, Dee Why.

But long before that point was reached traffic management authorities world-wide had become aware of another problem. It is one thing to install vehicle actuated traffic lights to handle one or two busy intersections in a city area, but quite a different proposition when all intersections in the main city thoroughfares need traffic lights.

In these circumstances it is no longer sufficient that each set of traffic lights operates as an island unto itself; some form of co-ordination between traffic lights is essential. Otherwise one set of traffic lights can give a green light to an empty street while traffic is banked up against a red light at the previous intersection.

What is needed is some form of co-ordination pattern which will synchronise the lights according to the predominant traffic density – ie, into the city during the morning peak and out of in the evening – and the rate at which it can flow.

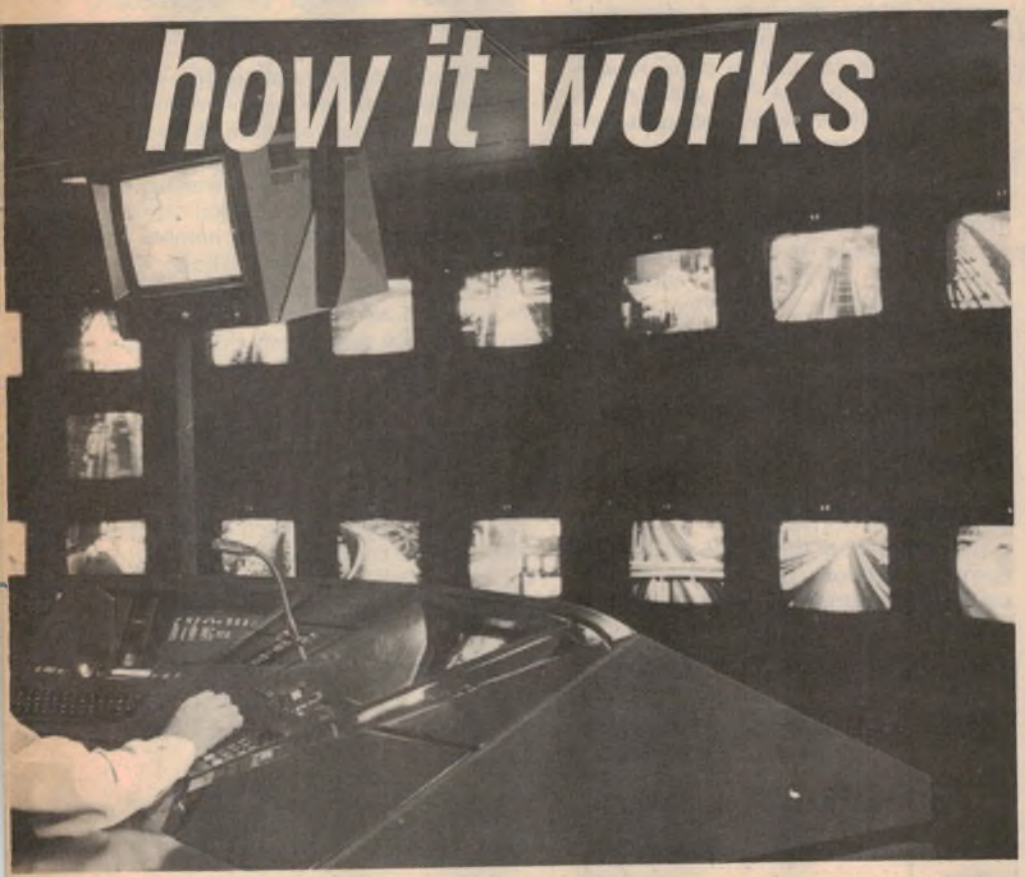
Various approaches to this problem were made by traffic authorities, with varying degrees of success, but always seeming to fall short of the ideal. Most schemes were based on a number of fixed traffic programs; programs based

A portion of the SCATS Control Centre showing some of the 32 TV monitors, two of the control consoles, and a graphics display set suspended from the ceiling.

Right: Close-up view of a console showing, right, the monitor screen and, left, the visual display unit. The operator is using the joy-stick control to position the TV camera.

light system

how it works



Sydney's first traffic lights were at the insection of Kent and Market streets. They commenced operation on 13 October, 1933. (DMR photo.)

on the average traffic flow in various directions according to the day of the week, time of day, and as many other predictable factors as possible.

To this was usually added a closed circuit TV supervisory system whereby traffic controllers in a central location could observe the general traffic flow, detect breakdowns or parking violations which were hindering traffic, and take steps to correct the situation.

This concept offered a considerable improvement, but still left much to be desired. In practice, it transpired that the actual traffic flow never seemed to really fit the program selected for it. And a sudden unpredictable event, such as a thunderstorm over the beachside suburbs on a Sunday afternoon, could catch the system napping.

Such a system was used in Sydney in the early 60s and, within the limitations already discussed, did a good job at the time. But, as traffic density increased, these limitations became more serious, and those concerned looked for a better way to make maximum use of the limited road capacity.

Co-ordinated systems

The result was our present day system, called SCATS – the Sydney Co-ordinated Adaptive Traffic System. It was developed by a team of traffic control and electronic engineers from the NSW Department of Main Roads and is claimed to be the most advanced system in the world. Proof of this is that other states and other countries have introduced systems based on it.

At the time of writing, SCATS (under different names) has been installed in Wollongong, Newcastle, Melbourne, Adelaide, Perth, and Canberra. Overseas it has been installed in part of Auckland, New Zealand, and a modified system derived from it is in operation in Kuala Lumpur, Malaysia.

The two operative words in the above title are "co-ordinated" and "adaptive". The co-ordination concept has already

Sydney's traffic light system

been mentioned and the adaptive is almost self explanatory; the system is designed to adapt automatically to changing traffic patterns.

The first approach to a co-ordinated adaptive system was made in 1964, when a TV monitoring system was first introduced into the central business district. The system used a variation of the fixed traffic program concept, the variation being that the officers in the control centre were provided with controls with which they could vary the pattern, according to the conditions they observed on the TV monitors.

The result was a manually operated adaptive system which was reasonably successful, at least initially. Unfortunately, as more traffic lights were brought into the system, and traffic density increased, it became unduly cumbersome. But the effort wasn't wasted; it gave rise to the concept of doing the same job using a computer rather than human operators and, from this, the modern SCATS concept was born.

The computer concept was first implemented around 1970, first with a small group of traffic lights, then progressively expanded until, by about 1975, all the central business district was under its control. Since then it has been expanded to cover the whole of the metropolitan area.

The control centre is in the State Bank Building in Oxford St, Sydney. The most visually impressive part of the centre is a bank of some 32 television screens, fed from a similar number of cameras mounted at stategic points around the city – usually well up on the side of buildings – plus a few from selected suburban sites.

Facing these screens are seven control consoles housing a wide range of operator facilities. Among these is a TV screen on which the operator can display the same image as on any of the 32 screens around the wall. And, with a joystick control, he can pan or tilt the camera, as well as zoom in or out for wide angle or closeup shots.

Two of the suburban cameras are located at bridges; one at the Tom Ugly's Bridge across the George's River, and one at the Ryde Bridge across the Parramatta River. Both these bridges are narrow by modern standards, having only three lanes, and have to be switched to give two lanes to major traffic flow.

Because of the distances to these cameras, and the high cost of dedicated coaxial cables, they use a slow scan system giving a new picture every eight seconds. This can use an ordinary low-cost telephone line. In spite of its limitations, the system is adequate for this particular application.

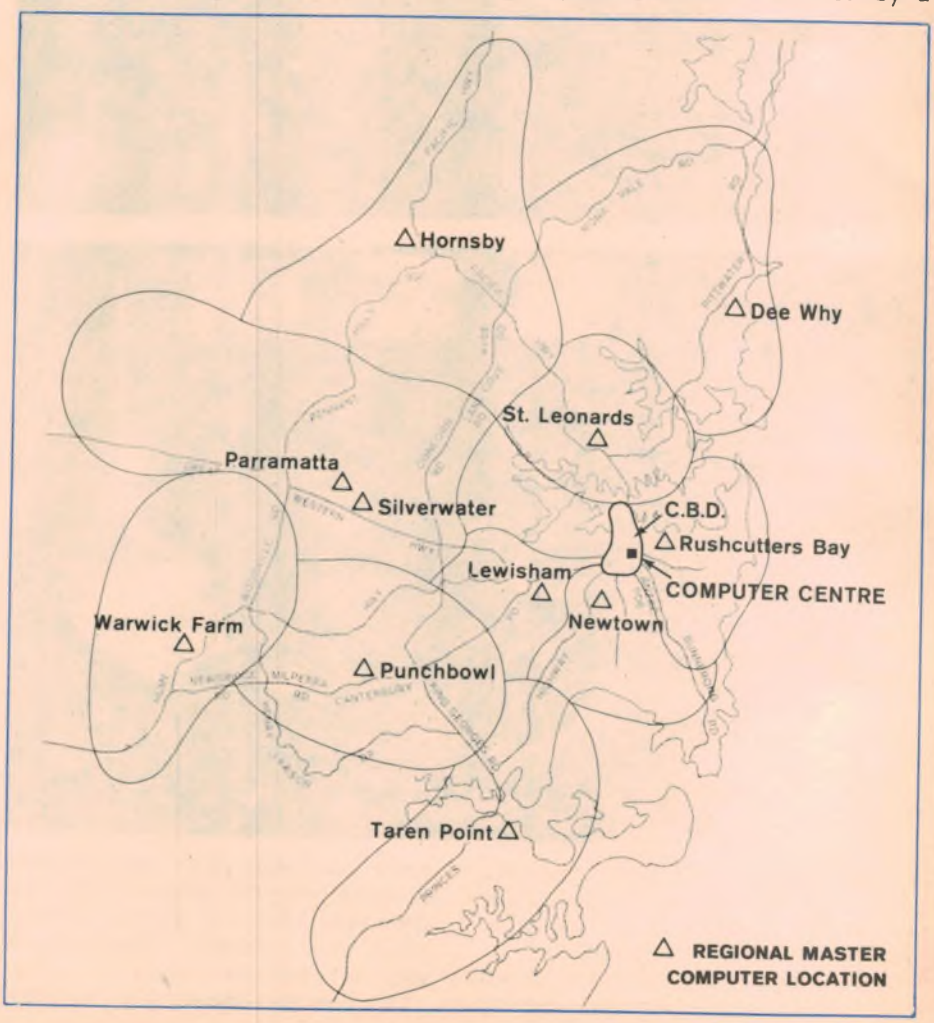
But, impressive as the TV system is to look at, it now plays a relatively minor role in the overall traffic control system. Its main use is to detect blockages caused by breakdowns, accidents, parking violations etc. When such a blockage is detected immediate steps are taken by either the Department, using its own towing vehicles, or by private tow-truck operators on contract, or by the police where this is appropriate.

Computer control

The real heart of the SCATS system is a complex network of regional master computers distributed throughout the metropolitan area. The whole system is divided into 12 sections, one for the city's central business district, as already described, and 11 throughout the suburbs. Each has its own master minicomputer, that for the central business district being at the Oxford St control centre, and the suburban ones in convenient buildings or blockhouses more or less central to the controlled area.

An interesting point about the system as a whole is the amount of information which can be derived from the vehicle detectors. While their primary purpose is to indicate that a vehicle is waiting at a traffic light, they can also indicate the traffic density, from the number of activations in a given time. The approximate speed at which the traffic is moving can also be determined, based on the space (time) between vehicles, since slow moving traffic tends to bunch and fast moving traffic to open out.

The 11 suburban systems are all autonomous, and work independently of adjacent systems. Each regional master minicomputer may control up to 120 sets of lights. At each set of lights there is a site controller, the familiar grey cabinet usually located on a nearby footpath. Each site controller contains a microprocessor which is linked by a



The Sydney metropolitan area covered by SCATS showing the regional master computers and the areas each one covers. Note also the City Business District (C.B.D) and the main computer centre. (DMR map.)

A regional map as drawn by the computer graphics system. It shows the St Leonards region (see main map) and includes the Sydney Harbour Bridge in the bottom centre of the picture (DMR photograph).

Interior view of an on-site controller, adjacent to a set of traffic lights.

Telecom line to the regional minicomputer.

By processing the raw data from the vehicle detectors and pedestrian pushbuttons on the spot, the microprocessor produces a much simplified signal for the regional minicomputer. The microprocessor also generates the various traffic light phases, but initiates them on instruction from the regional master.

Incidentally, the modern vehicle detector is an inductive loop buried in the roadway. The pneumatic type detector was used until about 1968, when the Department introduced the first inductive loops which have gradually taken over since then. They have the advantage that, being buried, they suffer no wear and tear or damage from passing traffic.

The use of on-site microprocessors also makes for a much simpler system, particularly in regard to communication links between the signal site and the regional master. As it is, this can be a single telephone pair whereas, without on-site microprocessors, it would probably need about six pairs, plus a lot of relays and similar equipment.

Each region is divided into a number of sub-systems, consisting of one major intersection and anything from one to 10 minor intersections adjacent to it. These are permanently programmed to work as a co-ordinated group and, under light or moderate traffic conditions, each group operates independently of every other group.

However, under heavy traffic conditions the system automatically "marries" two or more groups to provide a larger co-ordinated network programmed to favour the major traffic flow and clear it as effectively as possible.

Failure modes

One risk with a system like this is the possible loss of the line between the on-site microprocessor and the regional master. This could create a chaotic situation, particularly if it involved a major intersection at peak hours. To cope with this, each microprocessor has an alternative mode of operation, called the "fallback" mode. There are several fallback modes, and each site is programmed with one suitable for its location.

For a major intersection, a "fixed time" mode would be employed. This is a prepared program based on the time of day, day of the week, and the average traffic pattern at that time, derived from regularly measured trends. On the other hand, an adjacent minor intersection, involving occasional entry from a side street, would probably fall back to a simple vehicle actuated mode.

When the regional master detects such a line failure, it will make one of several possible decisions, depending on the grade of intersection involved and the fallback mode which it knows it will employ, as well as the traffic density at that time. For the minor intersection just described it would typically do nothing, apart from signalling the failure to the control centre.

For a major intersection, it would typically switch all other major intersections to the same fallback mode, thus co-ordinating the system to the same fixed program (each microprocessor is controlled by a highly accurate clock). Even though the fixed program is less effective than the adaptive program, it is a good deal better than a total failure, and will keep the traffic moving.

Earlier we mentioned two three-lane

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Spurious and Image rejection	50DB
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IF Frequencies:	1st IF 750MHz SAW Filter 3rd IF 455KHz Ceramic Filter 2nd IF 45.0275MHZ Crystal Filter (WFM) 5.5 MHz Ceramic Filter
Reference Oscillator	(Synthesiser) Crystal Controlled
Scanning Rate	Approx 5 Channels per Second
Search Scanning Rate	Approx 6 Seconds per mega-Hertz
Scan Delay:	Normal. Approx. 1 second With Delay Option Approx. 2.5 seconds
Search Delay	Approx. 2.5 seconds
Priority Sampling Rate	Approx. 2 seconds
Audio Output:	1W @10% or less Distortion
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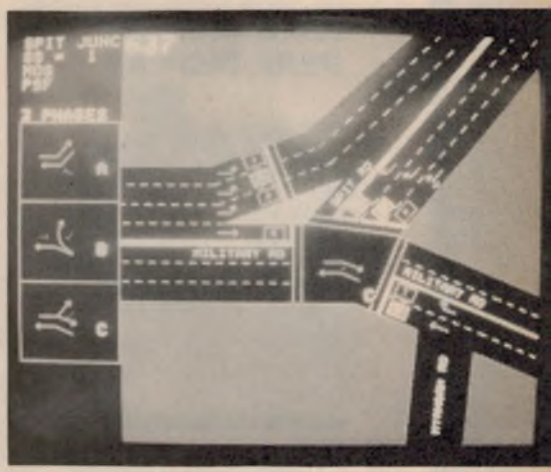
A view from inside the DMR helicopter, showing the northern approach to the Bridge, and the Opera House. The officer is operating a computer terminal with a radio link to the control centre. (Philips Industries photo.)

Another computer graphics map, this time of a single intersection, also in the St Leonards region. This shows each vehicle detector (numbered rectangles) and indicates its status by colour. (DMR photo.)



Sydney's traffic light system

bridges in Sydney's suburbs, one at Ryde and one at Tom Ugly's Point. These can present serious bottlenecks in some peak periods, and the system is programmed to make the best use of their capacity.

The problem is not so serious when there is a predominant flow in one direction. The system simply gives it two lanes and leaves it to the traffic to make the best of it. The real trouble occurs when there is an approximately equal and heavy flow of traffic in both directions, both probably wanting to move at a faster rate than one lane can accommodate.

The approach to this situation is to alternately transpose the one-lane/two lane configuration at frequent intervals – possibly as short as five minutes – so that, on average, each traffic stream is given the equivalent of one-and-a-half lanes. Traffic may still bank up, if it is heavy, but at least the best use is being made of the bridge capacity.

Each regional minicomputer is connected by a telephone line to the control centre in Oxford St. Among other things, this provides a means of monitoring the instantaneous status of that minicomputer, or any individual set of lights connected to it. The information may be displayed in two ways; in tabular form on the console's visual display unit, or as a map.

Computer graphics

The maps are generated by computer graphic systems and are displayed, in colour, on one of four graphic display sets suspended from the ceiling above the console. The maps can be drawn to three scales: a complete region, a sub-system, of a single intersection. On a regional display, colours are used to indicate the state of the traffic on major roads; from green for light traffic, through yellow and orange, to red for congestion. Purple signifies that a number of sub-groups have been "married", as previously explained.

Maps for individual intersections show the names of the streets, the location of each vehicle detector loop, and its current status; ie, green if the loop is clear, red if it is activated. When traffic is flowing the frequency with which vehicles activate these loops as they pass over them, the time they take to pass over them, and time between activations provide, collectively, a very good indication of the traffic density and speed.

The regional minicomputer will also raise an alarm at the control centre in the event that a set of signals fails, for any reason. The nearest signals repair team is then directed to the site.

The circuit from the regional minicomputer to the control centre works the other way as well. With it, an operator can override any part of the system down to an individual set of lights. This facility is not normally needed, except in emergencies. Typical would be a major traffic accident requiring ambulance, fire brigade, and police vehicles to reach the scene as quickly as possible.

In such a situation the TV monitors would be used to supervise the city area or, outside this area, a police motor cycle escort may accompany the emergency vehicle, using its two-way radio direct to the control centre to report its approach to each intersection.

Another feature involves the Department's helicopter, which carries a computer terminal on board, and can, if necessary, directly control an individual intersection via a radio link to the control centre. Again, this would be used only in very special circumstances.

And how effective is the system in practical terms; in moving traffic faster and with fewer stops? Surveys conducted by the Department indicate that, compared with an unco-ordinated system, on a typical urban arterial road, SCATS reduces travel time by 23%, vehicle stops by 46%, accidents by 20% and fuel consumption by 12%. This last figure represents a saving of 60,000 litres of fuel per year for each set of lights.

All of which adds up to a very effective system. The important point about it is that the system itself makes all the decisions, with virtually no human intervention. Such human intervention as does occur is largely supervisory, or to take over in an emergency, such as traffic accidents, faulty or damaged traffic lights etc. As a computer system capable of coping with widely varying conditions, and making "intelligent" decisions to suit, it represents a really significant achievement.

So next time you are halted by a red light, try not to be too impatient; there is a lot of equipment, with a lot of planning behind it, designed to make sure that you get your share of the roadway in the shortest possible time.

In conclusion, the author would like to thank the Department of Main Roads, NSW, and in particular Mr John Longfoot, Engineer Manager, Traffic Control and Emergency Centre, for their co-operation in the preparation of this article.

Electronics Australia reviews the Cat Computer

Apple compatible plus extensive graphics

Dick Smith Electronics has come up with a winner with the CAT personal computer, a system which offers extensive text and graphics display capabilities, music and sound effects, and a powerful Basic interpreter.

by PETER VERNON

The CAT computer from Dick Smith Electronics is actually two machines in one. In itself it is similiar to the Apple II but provides enhanced display capabilities and sound effects and a more extensive Basic interpreter. With the addition of an extra-cost emulator cartridge and disk drive the CAT becomes an Apple II "workalike", able to run most Apple II software.

Manufactured by Video Technology Limited of Hong Kong, the CAT is a big, heavy "all in one" unit with processor, memory and interface electronics packaged in the keyboard console. Dimensions are 486 × 248 × 65mm (W × D × H at rear), sloping to 45mm high at the front of the console. The colour scheme is beige and tan.

A 55 key alphanumeric keyboard and an 18 key numeric pad are provided, along with eight double-size function keys which in conjunction with the SHIFT and CTRL keys give 24 programmable functions. The keyboard is "dished", with the top surfaces of the keys arranged in a concave plane for comfortable typing, and special function keys are picked out in yellow and tan.

Automatic repeat operates on all alphanumeric keys and the programmable function keys are initially defined to allow single-key entry of commonly used Basic statements such as LIST and RUN.

One minor irritation is the positioning of the RUBOUT key above the RETURN key. It is a little too easy to reach for the RETURN key and instead delete a character accidentally.

At the rear of the console is an array of controls and connectors. From left to right (looking from the rear) are the rocker type power switch, an IEC socket for 240VAC power, a reset button, colour defeat switch, RGB output, composite video output, cassette interface connector, volume control for the internal speaker, a connector for an add-on RS-232C interface, system bus connector and a parallel printer port. An external RF modulator is also available.

The connector at the rear of the CAT console provides an audio output as well as composite video, while when using an RF modulator sound is heard from the speaker of the television set, in addition to the CAT's internal speaker (depending on the setting of the volume control). The "colour defeat" switch eliminates the chroma component of the video signal to provide a clearer picture when the CAT is used with a monochrome monitor.

Additional connectors on the right side of the console are for an expansion interface and a 9-pin D type socket for dual joystick controls. Tucked away underneath the console are two small slide switches, one to specify 50 or 60Hz operation and the other to select a 40 or 80 column display format. The width of the display can also be changed by software – the switch selects which format is operative when the system is first turned on.

The system bus connector at the rear of the console is normally used by an add-on floppy disk drive controller cartridge which allows the use of two 13cm minifloppy disk drives. The expansion port at the right takes the "emulator" cartridge, which in conjunction with special software on disk turns the CAT into an Apple II "workalike".

Given the recent furore over the "Wombat" computer, and the on-going debate about software protection sparked by Apple Computer's attempts to defend its investment, compatibility with the Apple II is no light claim. Prompted by Dick Smith Electronics, the manufacturers of the CAT have gone to some lengths to ensure that Apple copyright (if any) has not been infringed.

Features of the CAT

High resolution (560 × 192) graphics in six colours and bit-mapped 280 × 192 graphics in eight colours, a choice of 40 or 80-column text display in upper and lower case and three-voice sound effects and music capability are the high points of the CAT's capabilities. Couple this hardware with a Microsoft Basic interpreter with support for graphics and sound and the system has a lot of potential.

The Basic of the CAT is an expanded version of that of the Apple II, which was also written by the Microsoft company. There is one notable omission, however, in that the Apple II 40 × 40 "chunky graphics" mode is not available on the CAT. Typing "GR", which on the Apple II enables this mode, causes a syntax error on the CAT.

When it is not emulating an Apple II the CAT provides five video display modes. Two of these are text modes and allow either 40 or 80 characters per line, with 24 lines on the screen. Both upper and lower case characters are supported, although program statements typed in lower case will be converted to upper case when the program is listed. The conversion is not total however, as some of the parameters of program statements remain in lower case and will cause a syntax error when the program is run.

As well as converting all keywords to upper case the Basic interpreter automatically inserts spaces between statements and symbols, making program listings easier to read, although a little disjointed at times.

Using the WIDTH statement the text display can be formatted with any line

length between one and 80 characters, with displays of over 40 characters per line using a special half-size character set. On an inexpensive colour video monitor or converted television set there is not sufficient bandwidth to make these characters legible, and a wider bandwidth monochrome or RGB colour monitor is required to make this display mode useful.

The colour of characters, screen background and border can be altered with the TEXT statement, which takes three parameters, one for each colour selection, chosen from a range of eight.

Colours can also be swapped between characters and background with the INVERSE statement, although some colour combinations are unreadable on a low resolution monitor. Messages on the screen can also be highlighted with the FLASH statement, which causes text to alternate between INVERSE and NORMAL modes.

In addition to two text modes, the CAT has three graphics modes. The first is an Apple-compatible 280 × 192 resolution display in six colours (including black and white) but the effect of a colour specification varies according to the exact position of a pixel on the screen. Pixels in even-numbered columns are always either blue or magenta while pixels in odd numbered columns are either red or green. Two adjacent pixels, however, are always shown as white.

A second version of this same mode is also available, which limits vertical resolution to 160 points but allows four lines of text to be displayed at the bottom of the graphics screen.

The same resolution with more colours, is available in a "bit-mapped" mode which is not derived from the Apple II. This mode also has a resolution of 280 × 192 but allows eight colours, with no limitations on how colours are mixed on the screen. Two pixels placed next to each other will retain their individual colours.

A "double resolution" mode is also available, allowing displays of 560 × 192 pixels. Colour combinations are the same as for the Apple-compatible 280 × 192 mode display mode.

In practice, the bit image graphics mode results in the most pleasing displays. The limitations on the use of colour imposed by low and double resolution modes mean that the colour of an arbitrary line cannot be guaranteed and that coloured shapes will be incomplete.

Cat Computer

Note that except for a four line text area at the bottom of the graphics display screen, text and graphics cannot be mixed. When a graphics program does not perform as expected the computer often remains in the graphics mode, giving the user no indication of what has gone wrong. Returning to the text mode requires typing "TEXT", without the benefit of seeing what you type, or pressing Function key 4 (defined as "TEXT" by default).

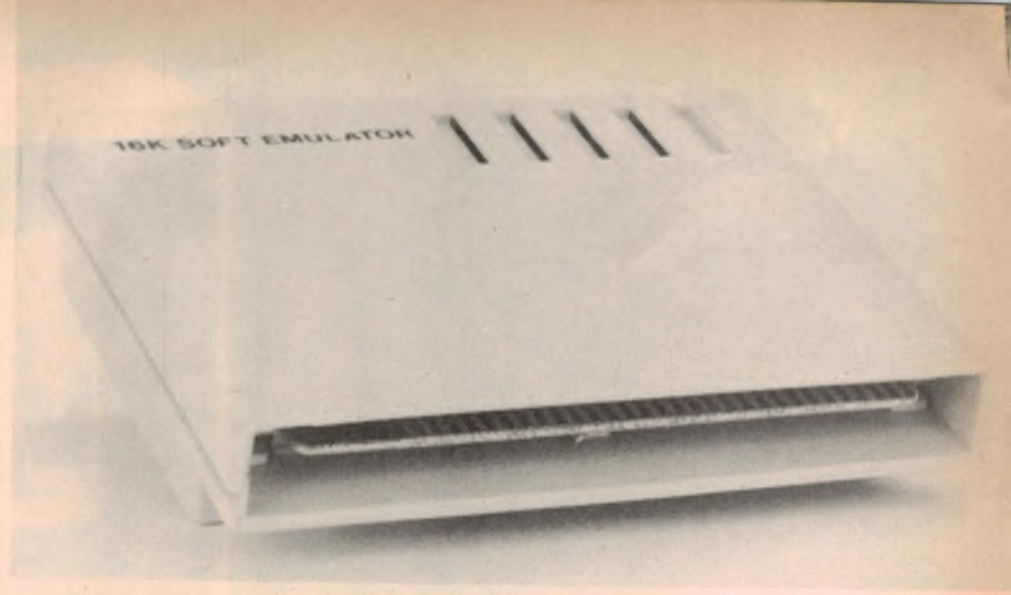
We tested the CAT on a colour television set converted for direct video entry and on the same set using an RF modulator and found that there was insufficient resolution to allow the 80 column characters to be legible. Colours were also "washed out", lacking in saturation, and the fine detail of some displays was lost.

We also tried an RGB video monitor, an AMUST unit made available by Dick Smith Electronics. This monitor connects to the RGB video connector at the rear of the console, and although small (28cm diagonal, 20 × 14cm usable area) provided a far superior picture. Colour displays were bright and fully saturated and details of the picture were crisp and clear. At around $700 though, the use of an RGB monitor adds considerably to the cost of the CAT system.

Basic statements and functions

The Microsoft Basic of the CAT is compatible with that of the Apple II but includes extensions to enhance the capabilities of the system. Program listings intended for the Apple II can be typed in as is and will run as specified, except for the "chunky graphics" mode.

SHLOAD, DRAW, XDRAW, ROT and SCALE support the "shape table" feature. Graphics shapes defined as a series of vectors can be stored in memory and reproduced at any point on the screen in Apple-compatible high resolution and CAT "double resolution" modes. Before drawing the shape can be rotated and/or scaled, and shapes can also be erased and re-drawn elsewhere for animated effects. Shape tables can also be saved on cassette or disk and re-loaded as required.



The emulator cartridge provides 16K of RAM to store Apple-compatible software.

Points and lines can also be plotted on the screen with the HPLOT statement. A pair of coordinates as parameters to this statement sets a single point, while HPLOT with two pairs of coordinates separated by "TO" will draw a line Multiple lines can be drawn with a single statement by adding further coordinate pairs, as follows;

HPLOT 0, 0, TO 279, 191, TO 0, 191 TO 0, 0

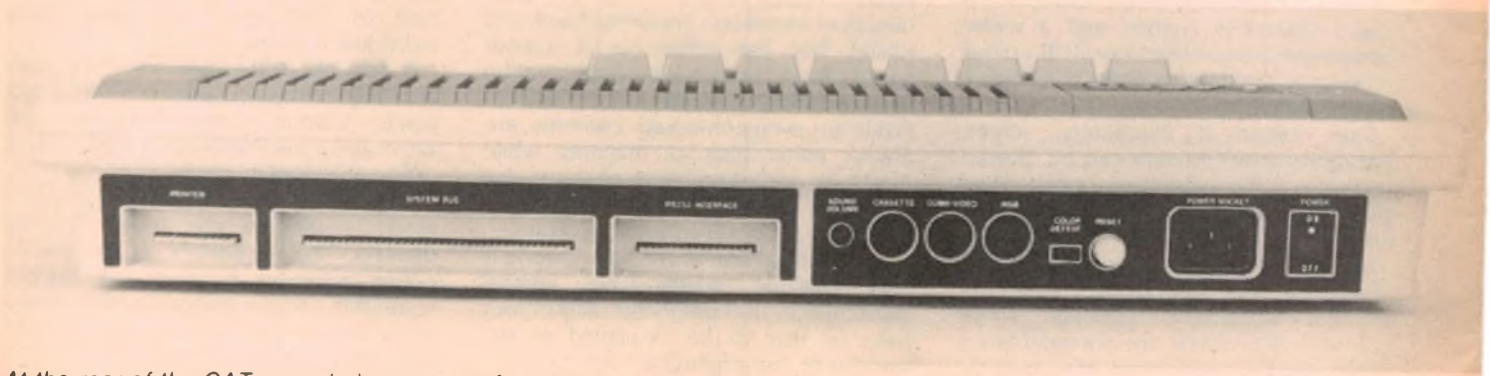
The task of graphics programming is further eased by statements such as DRAW SCIRCLE, DRAW HSQUARE and PAINT. Outlines of circles, arcs, rectangles and ellipses can be drawn with a single statement with the H prefix, while equivalent statements with an S prefix draw solid shapes. The PAINT statement is also available to fill irregular shapes with colour. It takes parameters specifying the point where PAINTing is to begin, the colour to be used as fill and the colour of the boundary at which PAINTing is to stop.

In addition to the graphics enhancements the CAT offers expanded sound effects and music capabilities. The original Apple II design allows only "single bit" sound activated by the BEEP statement. One bit of a particular memory location is connected to a small amplifier and internal speaker and is toggled on and off to create square waves with a frequency depending on the rate of switching.

While it is possible to produce music in this way, the amount of work required is out of all proportion to the effects produced. The addition of a separate sound generator chip in the CAT is therefore a welcome development to those unconcerned with Apple compatability.

Two versions of the SOUND statement control the three channel sound generator. The first version uses numbers between 1 and 63 to specify the pitch of each note, the duration, volume and sound channel to be used. Only one channel at a time can be activated with this version of the statement.

The second version of SOUND uses letters of the alphabet to specify notes over a seven octave range. The tempo, length and volume of any note can be specified, and more than one sound channel can be activated simultaneously. Each note is specified as one of A, B, C,



At the rear of the CAT console is an array of connectors including a printer port, expansion bus and two video outputs.

The CAT personal computer is an "all in one" unit with a keyboard and a numeric pad well-suited for prolonged use.

D, E, F, G in one of seven octaves, and optionally, as either sharp or flat.

SOUND C4 for example, produces the note middle C.

Percussion, phasor sounds and other effects can be produced with the NOISE statement, which controls a separate sound channel and allows either random ("white noise") or periodically varying waveforms with one of four predominant tones. Volume is specified as one of 16 levels between 0 (off) and 15 (maximum).

Duration of the sound is specified in increments of 1/50th second, using a parameter between 1 and 255. Longer noise effects are produced with two or more statements in succession.

Any of the graphics display pages of the CAT can be reproduced on an Epson type dot matrix printer using the Basic command PRINT SCREEN. This function is designed to work with the MX-80 and similiar printers, but not the Seikosha GP-100 series, which use a differently configured print head.

Program editing features are not as extensive as those of some other machines, and appear over-complicated. They are not mentioned in initial copies of either manual accompanying the machine, but books on the Apple II are applicable. At the time of this review revised manuals were in preparation.

Variable names in CAT Basic can be up to 40 characters long, a boon to programmers who like to write self-explanatory code. All numeric variables are stored to nine-digit accuracy, and there is no provision for designating particular variables as integers or double precision.

Use of machine language routines is well-supported. The "Ampersand" command (&), causes a Basic program to jump to a machine language routine starting at address $03F5 (hex). Naturally, a machine language routine must be stored in memory before the statement is used or the results will be extremely unpredictable.

The CALL statement is also available, allowing a more flexible use of machine code from Basic. CALL takes a variable which represents the (decimal) address of a machine language subroutine. The ROM-based "kernel" routines of the CAT, including a machine language monitor program, can be activated with the statement CALL -151. Machine language subroutines can also be entered with the USR statement, which causes a jump to a machine language subroutine pointed to by an address stored in locations 000A-000B.

The built-in machine language monitor program allows the contents of memory to be examined and altered and machine code programs to be entered and run, although there is no mention of this feature in the manuals accompanying the machine.

Software and expansion

Dick Smith Electronics has tested around 400 programs for the Apple II which will run on the CAT either with or without the emulator cartridge. A list of these programs is available on request.

By far the largest proportion of this list are games programs, with the spectacular graphics familiar to admirers of the Apple II. Games such as Crisis Mountain, Zaxxon, Microsoft's Flight Simulator, Missile Defence and all the Scott Adams Adventures run without the emulator. Others such as Three Mile

CAT specifications

Processor	6502 at 2MHz.
RAM	48K, 64K in emulation mode.
ROM	32K, partly overlaid by emulator.
Interfaces	Cassette port, games port, parallel printer port, expansion port, system bus, optional RS-232C.
Display	Text: 40 x 24 lines; 80 x 24 lines. Graphics: 280 x 192, 560 x 192.
Sound	Three voices, six octave range, programmable noise.
Software	24K Microsoft Basic in ROM; machine language monitor; Apple II compatible Basic on emulator disk.
Documentation	Under revision at time of review.

Island and Olympic Decathlon require the emulator.

Note that there is at present no software available for the CAT as such. None of the commercially available programs take advantage of the extra graphics and sound capabilities of the machine. A program written for the Apple II computer will run in exactly the same way on the CAT and would need to be modified to use the additional features of the machine.

We were however supplied with a demonstration disk which highlights the special capabilities of the CAT and each computer comes with a cassette copy of the same software. Additional purpose-designed programs may become available if independent software suppliers decide that the market is worthwhile.

Hardware expansion is at present limited to the disk controller cartridge, emulator and an RS-232C serial interface. The single expansion bus connector of the CAT is required for the emulator cartridge, while the external disk controller cartridge plugs into a bus connector at the rear of the computer. The RS-232C serial interface connects to its own port at the rear of the console.

The emulator cartridge is a bank of 16K RAM which can be switched in and out of circuit. It is equivalent to the Apple "language card" or other 16K memory expansion boards, and is supplied with a disk containing the DOS and copies of two Apple II compatible Basic interpreters. When the CAT is first switched on with the emulation disk in the drive, the disk operating system is loaded into the emulator memory and the user is asked to select either standard or integer Basic.

Some programs definitely need the additional facilities provided by the emulator. Unfortunately for the user there is no way of determining beforehand whether a program which is not on the DSE list will need the emulator.

Even with the emulator, not all Apple II programs will run on the CAT although the odds are good. Of 140 programs tested by one Dick Smith Electronics staff member, only one was found to be incompatible with the CAT emulator combination. Those programs which make extensive calls to the lesser used machine language monitor subroutines of the Apple II give the most trouble.

Sandy's Word processor and 80 column Visicalc for example, run when the emulator is fitted, but the Zardax word processor will not.

CAT Computer Basic statements and functions

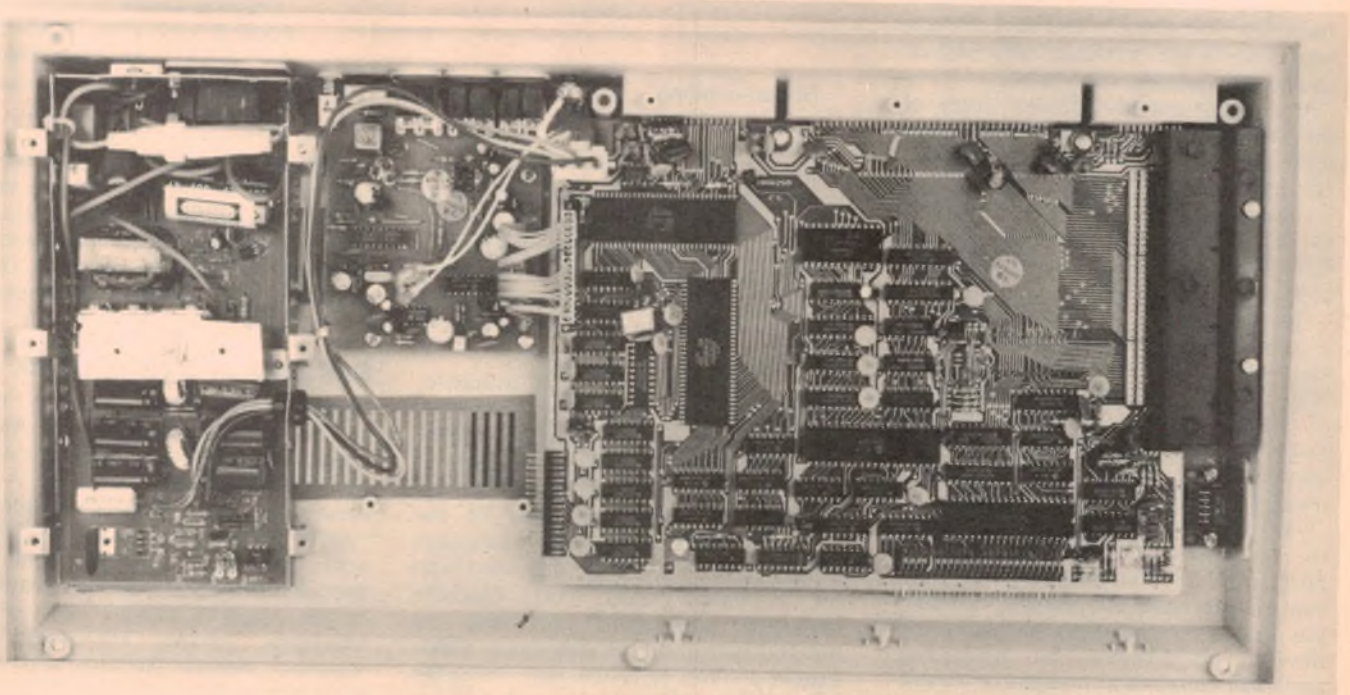
ABS, AND, ASC, AT, ATN, CALL, CHR$, CLR, CONT, COS, DATA, DEF, DEL, DIM, DRAW, END, EXP, FLASH, FN, FOR, FRE, GET, GOSUB, GOTO, HCOLOR=, HGR, HGR2,3,4,5,6, HIMEN, HOME, HPLOT, HTAB, IF, IN, INPUT, INT, INVERSE, LEFT$, LEN, LET, LIST, LOAD, LOG, LOMEM, MID$, NEW, NEXT, NOISE, NOT, NORMAL, ON, ONERR, OR, PAINT, PDL, PEEK, POKE, POP, POS, PR#, PRINT, READ, RECALL, REM, RESTORE, RETURN, RESUME, RIGHT$, RND, ROT=, RUN, SAVE, SCALE=, SGN, SHLOAD, SIN, SOUND, SPC, SPEED, SQR, STOP, STR$, STORE, STEP, SWAP, TAB, TAN, TEXT, THEN, TO, R TROFF, TRON, USING, USR, VAL, VTAB, WAIT, WIDTH, XDRAW.

In conclusion

If you want a machine which is compatible with the Apple II and which is supported by a reputable retailer, the CAT with emulator is good value. Readers will have to decide for themselves whether Apple compatibility is important to them and how much effort they are prepared to put into collecting and testing software for the system.

The best points of the CAT are its quality design and presentation, colour graphics and sound capabilities and powerful Basic interpreter. Even without Apple compatibility it is a personal computer worthy of note.

The CAT computer costs $699, with the emulator cartridge an additional $99. A controller cartridge for two disk drives costs $149, with half-height 13cm disk drives to suit at $349 each. The RS-232C interface is $129, and a pair of joysticks is available for $34.50. An Apple-compatible CAT with one disk drive is thus $1296 including the emulator, disk operating system and Basic.



Extensive use of LSI circuits in the CAT keeps the chip count low. Note the separate power supply board.

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IBM PC compatible hardware and software

CONDOR uses the superb MS-DOS 2.0 operating system and will run the countless packages designed to run under MS-DOS such as Lotus 1-2-3, Multiplan, Wordstar, Visicalc, DBASE II, CopyIIPC etc. CONDOR will also run CP/M-86 and associated software. Software supplied with CONDOR includes MS-DOS 2.0 (licenced by Microsoft Corp.).

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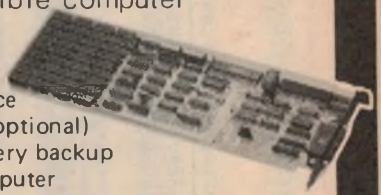

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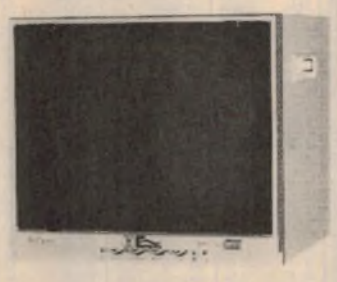

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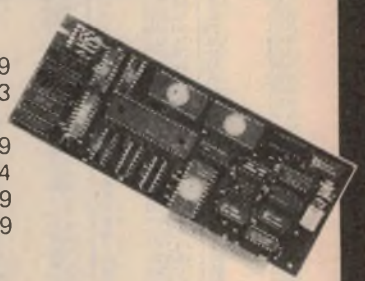

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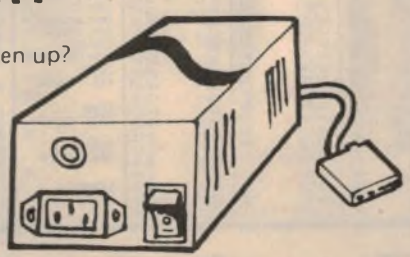

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7486 .70	74LS155 .52	74S40 .50	4017 1.00	9320 5.00	LM3089 2.90	2912 22.00	UA7812 .65		MRF901 2.80	2N5946 19.50	10UF/50V .40
7489 4.90	74LS156 .45	74S51 .42	4018 .78	9321 .88	LM3900 .58	2920 108.00	UA7812K 1.65	12V 5 WATT .70	TIP31 .40	2N5961 .19	22UF/50V .42
7490 .70	74LS157 .43	74S64 .45	4019 .60	9322 .55	LM3909 1.00	4116 1SONS 2.95	UA7815 .65	BZX61/C75	TIP31A .45	2N6027 .55	
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7495 .75	74LS161 .52	74S112 .68	4022 .66	9334 1.18	LM3911 2.00	6502 9.45	UA7818K 1.70	TRANSISTORS	TIP32 .44	2N6122 .60	.0015UF/100V .10
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74126 .57	74LS175 .80	74S139 .88	4029 .84	AD570 55.00	MC1445 3.90	6532 10.70	UA78L12 .40	AC161 1.70	TIP41C .76	2N6131 1.50	.0082UF/100V .10
74145 .75	74LS190 .83	74S140 .80	4030 .60	AD574 12.10	MC1456 1.60	6545 19.80	UA78L15 .40	AC162 1.70	TIP42 .80	2N6133 1.60	.01UF/100V .10
74147 1.95	74LS191 .79	74S151 .65	4031 3.25	ADC0804 5.50	MC1466 13.50	6551 13.80	UA78M05 .60	AF127 .98	TIP42A .78	2N696 .90	.015UF/100V .10
74148 .90	74LS192 .60	74S153 .65	4033 1.80	ADC0808 12.60	MC1494 7.40	6800 4.90	UA78M12 .60	BC107 .30	TIP42B .80	2N918 .45	.022UF/100V .10
74150 1.29	74LS193 .80	74S157 .80	4034 1.80	ADC0809 8.00	MC1495 7.20	6802 6.50	UA78P05K 15.70	BC108 .30	TIP42C .82	25A683 .70	.033UF/100V .10
74151 .60	74LS194	74S158 .78	4035 .90	ADC0817 13.60	MC1496 3.90	6808 4.50	UA78540 2.80	BC108C .35	TIP111 .68	2SC1017 2.60	.039UF/100V .10
74153 .50	74LS195 .80	74S161 4.50	4040 1.00	ADC1210 58.00	MC3340 1.40	6809 14.00	UA7905 .72	BC109 .30	TIP112 .75	2SC1061 .70	.047UF/100V .14
74154 1.45	74LS197 .80	74S174 .78	4041 1.00	AY-3-1015 6.50	MC3370 3.70	6810 3.20	UA7905K 1.85	BC109C .35	TIP116 .77	2SC1096 .72	.056UF/100V .14
74155 .80	74LS221 .80	74S175 .85	4042 .80	AY-3-8910 10.00	MC3470 9.00	6820 2.85	UA7908 .72	BC177 .35	TIP117 .83	2SC1106 4.80	.068UF/100V .18
74156 .83	74LS240 1.80	74S188 2.80	4043 .80	BR1941 11.50	MC3486 3.80	6821 2.70	UA7908K 1.85	BC178 .35	TIP120 .66	2SC1226 .95	.082UF/100V .18
74157 .80	74LS241 1.85	74S189 2.85	4044 1.00	BR1941 12.00	MC10116 1.40	6840 5.80	UA7912 .72	BC179 .35	TIP122 .72	2SC1306 1.50	.1UF/100V .18
74160 1.12	74LS242 1.90	74S194 1.50	4046 1.50	CA3028 1.90	MCM66740 16.00	6844 11.50	UA7912K 1.85	BC212 .20	TIP125 .77	2SC945A .25	.15UF/100V .18
74161 .80	74LS243 1.90	74S242 3.95	4047 1.00	CA3036 4.50	MM5303 6.50	6845 11.50	UA7915 .90	BC318 .15	TIP127 .96	2SD350A 2.25	.22UF/100V .18
74162 1.20	74LS244 1.95	74S253 .85	4048 .50	CA3039 1.60	MM5837 2.50	6847 7.50	UA7915K 1.85	BC327 .20	TIP2955 1.50	2SJ49 6.00	.27UF/100V .22
74163 .80	74LS245 2.10	74S257 .93	4049 .50	CA3059 6.50	MM5867 11.50	6850 2.50	UA79H05K 7.50	BC328 .20	TIP3055 1.50	2SK134 6.00	.33UF/100V .30
74164 .80	74LS248 .52	74S258 .99	4050 .50	CA3081 .99	MM58167 11.50	6852 2.70	UA79H12K 9.20	BC546 .15	2N301 3.90	3N201 1.80	.47UF/100V .34
74165 .79	74LS249 .82	74S283 1.80	4051 .72	CA3130 1.40	MN3001 14.50	6854 8.80	UA79H05K 7.50	BC547 .15	2N697 .42		.85UF/100V
74166 .99	74LS251 .55	74S287 2.50	4052 1.15	CA3130T 1.95	MSM58372 12.50	6875 12.50	UA79M12 .65	BC548 .15	2N918 .42	SCR & TRIACS	2.2UF/250V 1.25
74167 2.20	74LS253 .52	74S288 2.40	4053 .80	CA2140 .80	NE530 2.30	68A09 29.50	OPTO	BC549 .15	2N2219 .42	C1030 .65	3.3UF/250V 2.30
74174 .59	74LS257 .90	74S289 3.10	4055 2.20	CA3140T 1.95	NE558 1.90	68B00 6.50	4N25 .98	BC550 .15	2N2219A .48	C106D .80	4.7UF/250V 2.80
74175 .60	74LS258 .47		4060 1.00	CA3146 2.20	NE571 2.90	68B21 3.90	4N26 .98	BC556 .15	2N2222 .42	C122D 1.60	6.8UF/250V 4.90
74177 1.20	74LS259 .79	74C00	4063 1.10	CA3401 .99	NE5534 1.75	68B40 7.80	4N28 .98	BC557 .15	2N2222A .48	C122E 2.00	10UF/250V 5.90
74180 1.10	74LS266 .39	74C00 .60	4066 .80	DAC0800 3.20	NE5534AN 2.50	68B45 16.50	4N32 .98	BC557B .16	2N2369 .42	C2300 5.90	
74182 .70	74LS273 .89	74C02 .60	4068 .60	DAC0808 2.50	OM321 10.10	68B50 3.40	4N33 1.30	BC558 .15	2N2484 .42	Q4010L4 1.90	GREENCAPS
74184 1.05	74LS279 .44	74C04 .60	4069 .60	DAC1220 12.50	OM335 17.50	68B54 12.00	4N35 .98	BC559 .15	2N2646 .96	Q4015L5 2.70	HIGH VOLTAGE
74184 3.50	74LS283 .58	74C08 .60	4070 .60	DM8121 2.50	OM350 9.50	6880 6.90	MCT6 1.40	BC637 .35	2N2647 1.60	Q6010L5 3.20	01UF/630V .22
74190 .59	74LS290 .50	74C10 .60	4071 .60	DM8130 5.20	SA80600 6.50	6885A 5.90	MCT2 .95	BC639 .30	2N2894 .36	Q6015L5 3.50	.022UF/630V .24
74191 .99	74LS293 .80	74C14 .80	4072 .60	DM8131 2.95	SN76477 5.65	6886 53.00	FND357 1.60	BC640 .30	2N2904 .45	Q6025H 9.80	.033UF/630V .26
74192 .69	74LS295 .60	74C20 .60	4073 .60	DM8309 .64	SN76488 7.40	6888 42.00	FND500 1.40	BC670 .60	2N2905 .45	S4015L5 2.20	.047UF/630V .30
74193 .79	74LS352 .80	74C30 .60	4075 .60	DM8310 .88	TA7205 2.80	6895 5.20	FND507 1.60	BC971 .60	2N2905A .49	S4025H 8.20	.1UF/630V .38
74194 .70	74LS365 .80	74C32 .60	4076 1.00	DM8312 .54	TCA220 8.50	6896 5.50	FND800 3.50	BD135 .60	2N2906 .40	SC141D 1.30	22UF/630V .45
74195 .70	74LS366 .60	74C42 1.25	4077 .80	DM8316 .78	TL061 1.10	8085 35.00	TIL31A 2.50	BD136 .60	2N2907 .42	SC146D 1.65	33UF/630V .46
74196 .70	74LS367 .60	74C48 1.65	4081 .60	DS8820 2.50	TL062 1.55	8202A 57.00	TIL81 2.00	BD137 .40	2N2907A .49	SC151D 2.20	47UF/630V .50
74197 .70	74LS368 .60	74C73 .90	4082 .60	DS8830 2.70	TL071 .80	8203 57.00	BPW50 2.00	BD138 .40	2N3019 .46	ST2 .55	
74198 1.45	74LS373 1.80	74C74 1.00	4085 .60	DS8833 2.90	TL072 1.50	8206 117.00	COY89 .90	BD139 .40	2N3053 .46	ST4 .65	CERAMIC
74199 1.60	74LS374 1.80	74C83 2.10	4086 .60	DS8836 2.50	TL074 2.85	8212 1.60	MOC3020 2.10	BD140 .40	2N3054 1.74		1PF .08
74221 2.50	74LS375 .49	74C85 1.40	4089 2.10	DS8859 2.05	TL075 3.20	8214 1.80	MOC3021 2.50	BD233 .40	2N3055 .80	TANTALUM	1.5PF .08
74251 1.35	74LS377 1.10	74C86 .60	4093 .40	DS8869 1.80	TL081 .60	8216 1.65	MAN72A 1.25	BD235 .42	2N3302 .39	1VF 35V .19	2.2PF .08
74279 .60	74LS378 .52	74C89 3.70	4094 .90	DS75107 .80	TL082 1.20	8224 4.50	MAN74A 1.25	BD236 .42	2N3440 .80	.22UF/35V .19	3.3PF .08
74283 .68	74LS390 .69	74C90 1.40	4099 1.20	DS75108 1.20	TL084 2.35	8226 1.80	FCD820C .90	BD237 .44	2N3441 2.50	.33UF/35V .19	3.9PF .08
74290 .62	74LS393 .70	74C93 1.40	4104 2.30	DS75110 1.20	TR1602 7.30	8228 3.50	FCD825C 1.20	BD238 .44	2N3442 2.30	47UF/35V .19	4.7PF .08
74293 .85	74LS447 .72	74C95 1.50	4160 .80	DS75150 1.20	TR1863 6.70	8231 285.00	FCD850C 1.20	BD262 .75	2N3563 .18	1UF/35V .20	5.6PF .08
74298 .66	74LS629 4.90	74C107 1.05	4161 1.10	DS75154 .95	TR1983 9.00	8237 42.00	FPT1008 1.30	BD263 .75	2N3564 .18	1.5UF/35V .20	6.8PF .08
74365 .83	74LS640 1.70	74C150 3.40	4163 1.10	DS75451 .60	UA301 .48	8238 10.80	MSM3914 8.50	BD437 .46	2N3565 .18	2.2UF/35V .22	8.2PF .08
74366 .83	74LS670 .99	74C151 2.80	4174 .80	DS75452 .45	UA301H 1.35	8243 3.00	MSM3916 8.50	BD647 1.98	2N3566 .18	3.3UF/35V .23	10PF .08
74367 .83	8ILS95 1.85	74C154 4.65	4175 .80	DS75453 .80	UA305H 1.25	8251A 4.90		BD677 .62	2N3567 .18	4.7UF/35V .41	12PF .08
74368 .83	8ILS96 1.85	74C157 2.60	4194 .80	DS75454 .66	UA308 .58	8253 5.60	LEDS	BD681 .80	2N3568 .18	10UF/35V .55	15PF .08
74LS00	8ILS97 1.85	74C160 1.30	4409 5.60	FD1771 19.00	UA311 .62	8255A 3.50	3mm GREEN .16	BD682 .80	2N3569 .18	ELECTRO PCB	18PF .08
74LS00 .40	8ILS98 1.85	74C161 1.05	4411 10.50	FD1791 36.00	UA311H 1.30	8257 6.50	3mm RED .10	BD694B 3.10	2N3638 .18	1UF/50V .15	22PF .08
74LS01 .40	74F00	74C162 1.25	4419 3.40	FD1793 30.00	UA324 .90	8259 4.70	3mm YELLOW .16	BD695B 3.10	2N3640 .18	2.2UF/25V .15	27PF .08
74LS02 .40	74F00 .70	74C163 1.20	4469 13.50	FD1795 35.00	UA339 .45	8271 97.00	5mm GREEN .16	BD96 BVX 80	2N3641 .18	4.7UF/25V .15	33PF .08
74LS03 .40	74F02 .70	74C164 1.50	4495 2.80	ICL7106 13.50	UA348 1.40	8272 30.00	5mm RED .10	3.50	2N3642 .18	10UF/25V .15	39PF .08
74LS04 .60	74F04 .70	74C165 1.65	4500 5.80	ICL7107 17.00	UA393 .52	8273 59.00	5mm YELLOW .16	BD97 BVX 80	2N3643 .18	33UF/25V .15	47PF .08
74LS05 .40	74F08 .70	74C173 1.00	4502 .88	ICL7660 4.80	UA555 .60	8274 44.00	Z0162	3.50	2N3644 .18	47UF/25V .15	56PF .08
74LS08 .60	74F10 .75	74C174 1.00	4503 .68	ICM7217A 17.50	UA556 .90	8275 45.00	RECT GREEN .25	BF115 .57	2N3646 .18	100UF/25V .16	68PF .08
74LS10 .25	74F11 .75	74C175 .90	4507 .60	ICM7218A 18.00	UA709 .58	8276 24.00	Z0164	BF167 .60	2N3702 .27	220UF/25V .20	82PF .08
74LS11 .40	74F20 .75	74C192 1.55	4508 1.20	ICM7555 1.90	UA710 .75	8282 8.40	RECT YELLOW .25	BF173 .60	2N3704 .25	330UF/25V .25	
74LS12 .40	74F32 .75	74C193 .95	4510 .80	ICM7556 2.70	UA711 .60	8283 8.40	FLS010	BF180 .80	2N3771 3.20	470UF/25V .35	STYROSEAL
74LS13 .40	74F64 .75	74C195 1.65	4511 .80	LF347 1.95	UA723 .49	8284 10.40	5mm LED CLIP .08	BF184 .70	2N3772 3.60	1000UF/16V .40	56PF/630V .25
74LS14 .40	74F74 .85	74C200 12.95	4512 .70	LF351 .60	UA723H 1.30	8286 8.40		BF198 .22	2N3773 4.30	1000UF/25V .50	68PF/630V .25
74LS20 .40	74F86 1.10	74C221 2.65	4514 1.70	LF353 .90	UA725 2.50	8287 8.40	DIODES	BF199 .22	2N3819 .60	2200UF/25V .85	82PF/630V .25
74LS21 .40	74F109 .96	74C240 3.35	4515 1.95	LF356 1.25	UA739 .99	8288 25.00	IN4148 .03	BF337 .50	2N3866 .86		100PF/630V .25
74LS26 .40	74F138 1.58	74C244 2.60	4516 1.00	LF357 1.25	UA741 .60	8289 32.00	IN914 .03	BF458 .51	2N3904 .20	ELECTRO AXIAL	120PF/630V .25
					UA741H 1.15	8291A 43.00				47UF/63V .19	150PF/630V .25
										1UF/63V .19	180PF/630V .25

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"BIG BOARD II"

Over 1,000 sold

Jim Ferguson, designer of the "Big Board" distributed by Digital Research Computers, has produced a stunning new Computer, "Big Board II". It has the following features:

4 MHz Z80-CPU AND PERIPHERAL CHIPS
The Ferguson computer runs at 4 MHz. Its monitor code is lean, uses Mode 2 interrupts, and makes good use of the Z80-A DMA chip.

64K DYNAMIC RAM + 4K STATIC CRT RAM + 24K E(E)PROM OR STATIC RAM
"Big Board II" has the three memory banks: the first memory bank has eight 4164 RAMs that provide 60K of user space and 4K of monitor space. The second memory bank has two SKx8 SRAMs for the memory-mapped CRT display and space for six 2732 As, 2Kx8 static RAMS, or pin-compatible E(E)PROMs, the third memory bank is for RAM or ROM added to the board via the STD bus. Whether bought as a bare board, a full kit, or assembled and tested, it comes with a 450nS2732A EPROM containing the monitor.

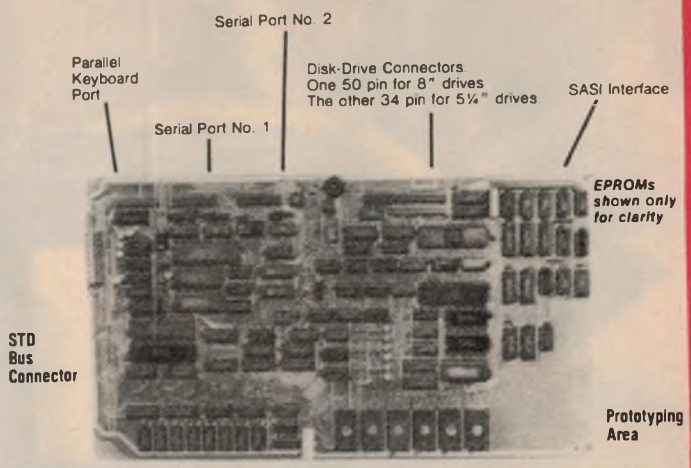
MULTIPLE-DENSITY CONTROLLER FOR SS/DS FLOPPY DISKS
The new Ferguson single-board computer has a multiple-density disk controller, it can use 1793 or 8877 controller chips since it generated the signal with TTL parts. The board has two connectors for disk signal with 34 pins for 5.25" drivers, the other with 50 pins 8" drives.

VASTLY IMPROVED CRT DISPLAY
The new Ferguson SBC uses a 6845s CRT controller and 8002 Video Attributed controller to produce a display that will rival the display of quality terminals. Characters are formed by a 5 x 7 dot matrix on 15.75 KHz monitors and 7x9 dot matrix on 15.75 KHz monitors. The display is user programmable with the default display 24 lines of 80 characters.

STD BUS CONNECTOR
The Ferguson computer brings its bus signals to a convenient place on the PC board where users can solder a DSTD, bus cards can be plugged directly into it, and it can as well be connected by bus cable to industry-standard card cages.

A Z80-A S10/0 = TWO ASYNCHRONOUS/SYNCHRONOUS SERIAL PORTS

TWO Z80-A CTCs = EIGHT PROGRAMMABLE COUNTERS/TIMERS
The new Ferguson computer has two Z80-A CTCs. One is used to clock data into and out of the Z80-A S10/0, while the other is for systems and application use.



PROM PROGRAMMING CIRCUITRY AND SOFTWARE
The new Ferguson SBC has circuitry and drivers for programming 2716s, 2732(A)s, or pin-compatible (E) EPROMs. Software $25 extra.

CP/M
CP/M with Russell Smith's CB10S for the new Ferguson computer is available for $230 + TAX
The CB10S is available separately for $65. + TAX
Actual board size: 39.6cm x 22.2cm. 5 inch B10S being developed. Approx price $95 + TAX

Kit Price

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- ★ Serial I/O (6551) for RS232C or 20 MA loop.
- ★ Centronics compatible parallel printer interface. (6522)
- ★ Buss expansion interface with DMA channel. (6844)
- ★ Dual timer for real time clock application.
- ★ Powerful on board system monitor (2732). Features commands such as Go To, Alter, Fill, Move, Display, or Test Memory. Also Read and Write Sectors. Boot Normal, Unknown, and General Flex™.

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Philips "Trendset" features what they describe as the "ultra-modern monitor look".

Another revolutionary idea from Matsushita: a projection type portable receiver/monitor, smaller, lighter and more economical to operate than a conventional design.

TECHNOLOGY IS CONSTANTLY ON THE MOVE...

We get frustrated, at times, when something we've just purchased is superseded by a new model or, worse still, by a new idea. But it's unavoidable at a time when technology is expanding faster than at any time in history.

by NEVILLE WILLIAMS

It's not so long ago that a colour television receiver was a marvel enough in itself – the fulfilment of John Logie Baird's dream from the 1920s. But in the last decade, modern-day inventors have found many roles for the glowing screen other than mass entertainment.

It is being used to display captions for viewers with impaired hearing; information received via off-air teletext, or obtained by phone line access; the readout from a domestic computer, or maybe a computer in another city or another country; full-colour graphics derived mathematically or hand-drawn; graphics for electronic games; information, lyrics or still pictures from the tracks of compact audio discs. And so on.

These new developments, plus the provision of hifi-stereo sound, are all set to change the TV/video marketing pattern in Australia from now on. Over the past few years, television sales have centred around small receivers, bought as a second set, but this is only half the picture, according to Heacliffe Teal, Director of Vesa Wholesale, Australian distributors for the Blaupunkt range of receivers from Bosch (West Germany). He says:

"Now, with the introduction of stereo sound and receivers that cater for such new technology as teletext and/or caption TV, we are set to see the replacement of primary household sets. This will result in a dramatic increase in sales of 63cm models."

Based on their experience in West Germany, Bosch/Blaupunkt expect that a significant proportion of new 63cm receivers sold will be up-market models with such features as full remote control, two-channel sound for stereo or bilingual programs, easy adaptability for teletext and possibly videotex, access for audio and video systems, etc.

In keeping with this, the local distributors have announced the release of a new range of modern Blaupunkt domestic receivers (pictured). Two have 53cm (diag) screens, two have 63cm screens, while the fifth and top-of-the-range model has a 63cm screen plus a self-contained multi-head VCR.

All include stereo (or two-channel) sound circuitry, plus dual loudspeakers and provision for connection to an external hifi system and to external audio/video accessories. All have full-function infrared remote control units, with provision to control both picture and sound, and all are readily adaptable to teletext and, in some cases, to videotex as well.

[For details of the Blaupunkt range of receivers, contact: Weston Communications Group Pty Ltd, 2nd Floor, 31 Coventry St, Sth Melbourne, 3205. Phone (03) 690 7404].

Receiver/monitors

While manufacturers other than Bosch have announced – or will be announcing – self-contained, high technology receivers, another quite different trend is emerging: the "monitor" concept. It assumes that many

householders will ultimately want to group their video and hifi equipment to form a single "entertainment centre", with quality loudspeakers to handle all sound and a quality monitor or VDU (visual display unit) to provide the picture.

Sony was one of the first into this field in Australia, with their "Profeel" range of video monitors, announced in the early part of '82. They had no in-built tuner but the picture circuitry could handle video from external sources, irrespective of standard: PAL, SECAM or NTSC.

About the same time, for those with higher ambitions and a bank balance to match, Sony were offering their VideoScope projection system – virtually a video monitor with a home-movie size screen.

In mid '83, Sharp released three receiver/monitors aimed directly at the consumer market and setting the style for other models to follow. Reviewed in our July '83 issue, they comprised a 13cm (diag) all-purpose portable and two deluxe domestic models with 34cm and 38cm screens. As the term receiver/monitor implies, they could be used either as self-contained receivers or interconnected by audio and video cables to peripheral equipment, in the role of a monitor.

As yet, not many viewers have actually implemented the idea of a domestic entertainment centre but the concept of a TV set as a piece of equipment rather than a piece of furniture is certainly gaining ground. Philips new "Trendset" range is evidence of this, with sales literature which describes it as "featuring the ultra-modern monitor look" in traditional silver-grey or in other colours, if preferred.

In a larger monitor format, Philips have their "Match-line" receiver which is similar in concept and appearance to the Sony Profeel.

Philips have also released a new range of domestic television receivers which incorporated teletext and stereo sound. Apart from these features, the new Philips receivers represent a departure from previous designs in that there are few controls on the sets themselves and a cordless remote control lets the user select any function including all teletext functions.

Philips sets will also feature direct video and audio inputs and outputs, stereo headphone socket and direct RGB inputs for high quality graphics presentation when using computers or video games.

Digital processing

A video monitor or receiver/monitor can be designed around conventional TV receiver circuitry, with appropriate concessions to styling, possibly tighter performance specifications, and provision for direct access to internal

Above & left: this new generation 63cm set from Philips features stereo sound, RGB inputs, teletext and a full-function remote control.

Below right: featuring digitally-based signal processing, this developmental receiver/monitor from Matsushita represents a complete departure in TV receiver design.

TECHNOLOGY IS ON THE MOVE...

video (and audio) circuitry. The mere ability to inject signals at video level rather than via an RF modulator can markedly improve image quality, particularly when displaying computer graphics. This was very evident in our evaluation of the Sharp models, mentioned earlier.

While the ultimate quality from a monitor or receiver/monitor will be limited by the field, line, resolution and chrominance standards of all current TV systems, there is good reason to minimise further possible losses in the video circuitry and to be alert for any technique that may subjectively enhance the on-screen image.

Working along these lines, engineers at Matsushita, Japan (National Panasonic) have recently come up with a developmental TV receiver (pictured) in which the incoming analog video signal is first converted into digital form and then processed by digital rather than analog technology.

According to the press release, Matsushita's digital TV receiver uses two ICs (integrated circuits) and four LSIs (large scale integrated circuits) including a newly developed CPU (central processing unit). The digital receiver has 30% fewer components than equivalent analog circuitry, reducing cost and increasing reliability. Matsushita claims that digital processing gives a "crisper, cleaner image due to a reduction in spots, screen flickering and colour saturation effects". (At the time of writing we are not sure just what is the level of these improvements and what they will mean to the average viewer).

No less to the point, they say, the digital approach makes it very much easier to include provision for teletext and videotex and to provide input/output facilities for VCRs, home computers, hifi systems and other facets of component video.

The remote control system which has been developed along with the digital TV receiver uses an 11-bit digital signal system which is theoretically capable of controlling up to 2048 functions. It can very easily control all the functions of the receiver, with ample spare capacity to control the peripheral equipment as well.

It would be a matter of knowing which buttons to push!

Further to demonstrate the versatility of the digital system, the Matsushita receiver can superimpose a second full-colour video image on the main image,

The new range of Blaupunkt receivers feature full function IR remote control, two-channel sound, provision for external audio/Video connections and adaptability for teletext and videotext.

allowing the viewer to keep track of a second program. The 15cm inset picture can be moved at will to any of the four corners of the 50cm screen.

Initial release of the digitally based receiver/monitor will be to the Japanese domestic market and to other major NTSC areas. Plans for the Australian market have yet to be announced.

A novel portable

What if tomorrow's customer wants a small, compact receiver/monitor, for use in the office, or a hotel room? Matsushita's backroom team have been working on that, too. They have come up with a portable projection type unit with a 16cm (diag) screen, which folds down and collapses into a case measuring 250mm x 310mm x 85mm (W x D x H) and weighing 3kg. It can be used as a normal TV receiver but can double as a display terminal for video signals and information, including teletext and videotex.

Based on the technology of Matsushita's large-screen projection TV system, the new developmental portable uses three 5cm projection tubes for red, green and blue images and a flat, rectangular screen with a Fresnel/lenticular surface. It can operate from an AC or DC supply or from rechargeable batteries, drawing a mere 12 watts.

Matsushita point out that conventional colour TV receivers, providing a picture of comparable size from a single colour tube, end up twice the size, twice the weight and draw twice the power.

This receiver, too, is planned for initial release in Japan, with no commitment as yet to a version for Australia.

8mm video cassettes

Right now, the hottest issue on the world video scene is Kodak's intention to release a camcorder (single-unit video camera/recorder) during the current year, using 8mm cassette tape. While designed primarily for portable use, it would have a companion mains-powered cradle and a tuner/timer to permit its use as a domestic VCR.

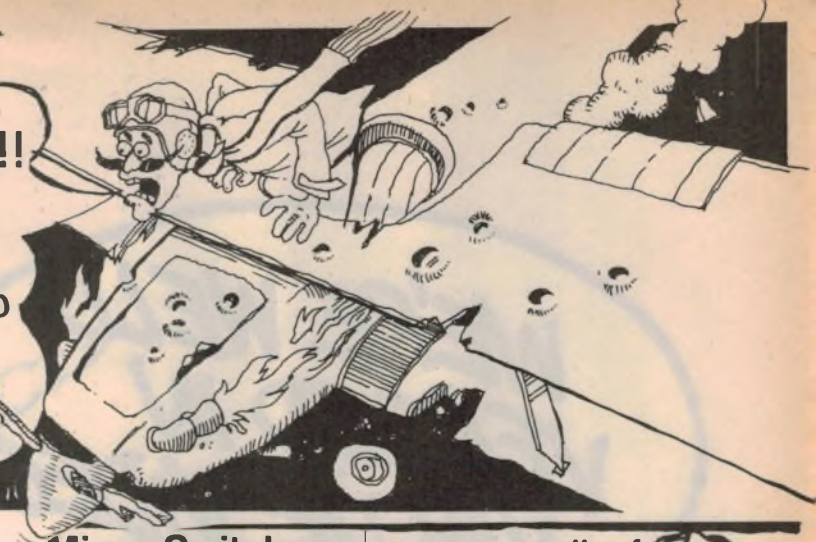
The Kodak announcement gained credence from the fact that the equipment is being produced in Japan by Matsushita (National Panasonic) with the special metal particle or evaporated metal tape coming from TDK. In addition, both RCA and GE have announced that they will take up the format, although it may have been more a statement of intention than an immediate commitment.

It remains to be seen whether Kodak will be able to move as quickly as planned, and how the remainder of the industry will react. Present indications are that most manufacturers will stay with the existing formats, as originally intended, and simply leave it to Kodak to do the spadework on 8mm – until they feel that the time is ripe to move in.

However, Kodak and anyone else who moves in too soon, face the risk that the standards consensus could fall apart, with the dissidents making a bid for supremacy with a later, higher technology variant.

MAY DAY MAY DAY

Prices Head for Crash Landing!!



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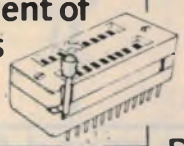
2114LP2 (low power) **$1.50 each, $1.30 10up**
2764-4 $13.00, **$11.00 10up**

New Shipment of Textool ZIFs



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24 pin **$11.50**
28 pin **$14.00**

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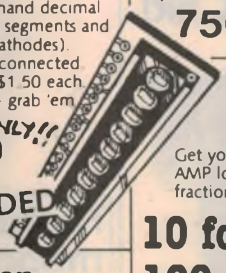
These superb 7 segment displays have thousands of uses. Each digit is 7 segment with right hand decimal point. Eight inputs for segments and 12 inputs for digits (cathodes). Anodes are internally connected. They were selling for $1.50 each. Reduced this month – grab 'em now!!

THIS MONTH ONLY!!

only $1.00



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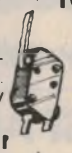

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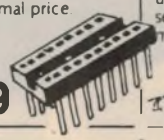

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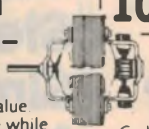

These motors are fantastic value. Thousands of uses. Grab one while you've got the chance !!

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Grab these top quality resistors. Great for power supplies, amps etc. Fraction of the normal price, while they last.

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U.S. made precision at Japanese copy prices.

If you've been looking for a digital multimeter, you'll know Fluke are the best. We are the only company in Australia to discount Fluke. Now you can afford a quality U.S. made precision instrument for no more than a hobbyist's meter.

Fluke 73

- ★ Unique Digial **PLUS** analogue display
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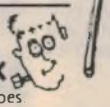

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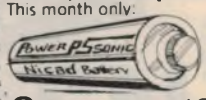

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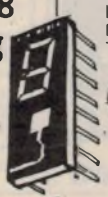

This incredble display chip has thousands of uses and at this price you can afford to use them for experiments. .27" red 7 segment display with built in counter logic and BCD input. Left hand decimal point.

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It's got everything!

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Having trouble with video leads? No more! This incredible video lead pack will match ANY video to ANY video with its unique plug & socket system. Cat W-1287

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5 up... $5.95

DICK SMITH ELECTRONICS

See page 98 for full address details.

A 710 Jt.

TECHNOLOGY IS ON THE MOVE...

There could well be room for such a move because the consensus standards, as used in the "Kodavision" equipment, are essentially an extension and a refinement of existing VHS/BETA technology, offering similar results from a smaller package.

Mr E. G. Woods, Managing Director and Chief Executive Officer of Kodak (Australasia) Pty Ltd described the picture quality available from the 8mm system, in terms of colour, sharpness and hue, as "excellent" and "at least equal to that from the half-inch systems".

Noel Proudfood, of Eastman Kodak's Photographic Technology Division gave much of the credit for the reduced dimensions to the use of metal particle or evaporated metal tape, both of which offered a potential data packing density from 30% to 50% greater than present oxide tapes. With high-precision amorphous metal heads, this permitted the same order of information retrieval, as for the present system, but with narrower tracks and at a scanning speed of 3.8m/s, which is much lower than either VHS or BETA.

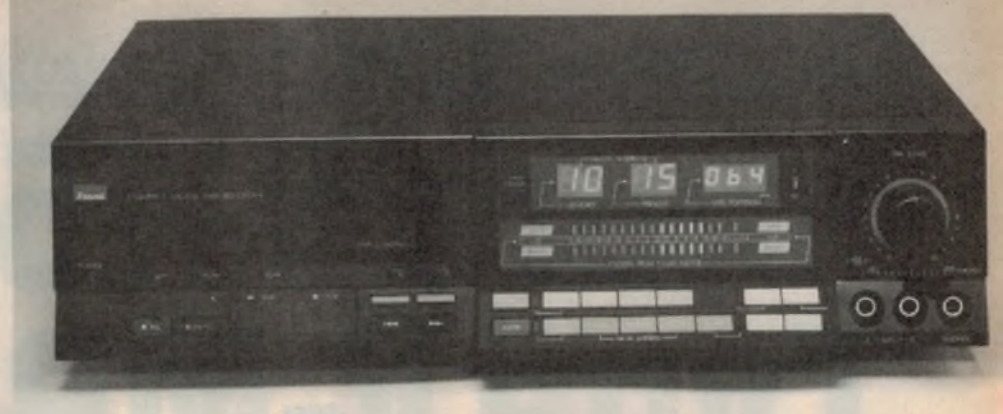
An 8mm audio format?

This brings me to another intriguing development – a high quality stereo sound recorder using the self-same 8mm metallised tape video cassette.

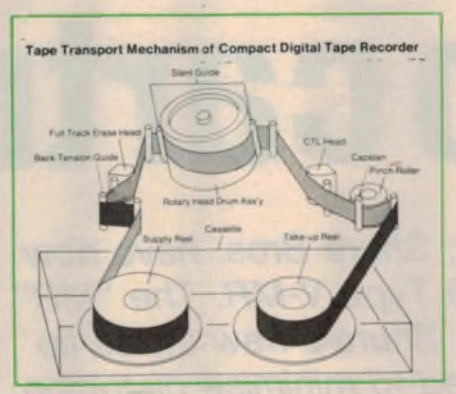
In mid '82, in company with a number of other technical journalists, I visited Matsushita's VCR factory in Osaka, Japan. At the time, we were probing to find out what we could about 8mm video but, like most other manufacturers at the time, Matsushita were not very forthcoming.

During the conference, I suggested that an 8mm video cassette might prove very suitable for high quality audio recording. With their SV-P100, National were already recording top quality audio on a standard VHS cassette. It should be possible to obtain equivalent performance from an 8mm system, with the advantage that the cassette was of more convenient dimensions – much the same, in fact, as an existing compact audio cassette.

The Matsushita engineers were at their inscrutable best, even when my query was raised again later. I was left in doubt as to whether they hadn't thought about it, or whether they didn't want to admit to anything. Perhaps it was simply inappropriate for a video engineer to get involved in audio recording; that was the concern of another factory, elsewhere in the city!



First exhibited at the Japan Audio Fair, this prototype Sansui Compact Digital Tape recorder (CDT) is a logical extension of 8mm video technology.



The Sansui CDT audio recorder would appear to use a normal 8mm M-loading video tape drive but run at half normal drum and tape speed to give a 3-hour play/record time.

Later on, I put the idea to Bill Andriessen of BASF (Germany) who admitted that it made a lot of sense. However, he pointed out that there was quite a gulf between European and Japanese thinking on a future audio tape format. In general, the European companies preferred something about the size of the compact cassette. It was big enough to handle and label conveniently, without being too big. The Japanese seemed more inclined to something about the size of the microcassette; why make anything larger than you strictly have to?

Now, out of the blue, Sansui have come up with a developmental prototype of the very thing I have been talking about – a high quality stereo audio recorder, using a standard 8mm video cassette. They have christened it the Sansui CDT (Compact Digital Tape) recorder.

An accompanying diagram of the tape traverse mechanism suggests a scaled down version of the VHS system, basically similar to that used in 8mm video recorders. The only dimensional reference is to a drum diameter of 40mm but deduction suggests that, for audio recording, the mechanism is being run at half the normal NTSC speed (ie, at 900rpm) thereby preserving the normal track width but doubling the playing time: ie, from 90 minutes to 180 minutes for an evaporated metal cassette.

(An option which Sansui mention without elaboration is that of operating the recorder in long-play mode, giving a record/play time of six hours).

A feature of the system is that it allows the program to be cued to 1/30-second accuracy for subsequent editing, programmed play, etc. Provision has been made to give each segment an absolute address, which the unit can locate on its own initiative.

Sansui admit that, in terms of random access, tape cannot rival disc, but their CDT system does allow the tape to be scanned at 200 times the normal speed. Automatic Edit Listening is also available when the user simply wants to fast-forward over unwanted segments, commercials, etc.

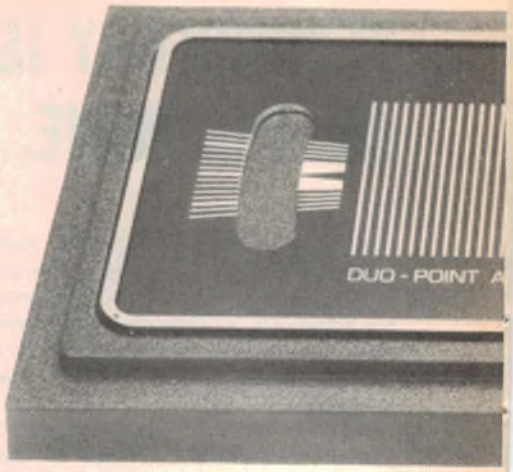
The prototype CDT (pictured) is an interesting hybrid between a video recorder, audio recorder and CD player, with front loading, a variety of Play/Record/Pause and tape traverse pads, microphone and headphone jacks, recording control and level indicator, plus buttons for editing and programming, and readouts for memory, tape position, etc.

No specifications are given in terms of actual performance but Sansui refer to it as a modern example of PCM recording suitable for either professional or amateur use.

Sansui claim that the CDT is the first unit of its kind. It will be interesting to see whether it also turns out to be the last or whether other manufacturers take up what would appear to be a very logical spin-off from 8mm video technology. If they do, hifi buffs may gain access to a deck exceeding the versatility of a compact cassette player and rivalling the performance of compact disc.

Electronics Australia review

Shure V-15 Type V-MR photo cartridge

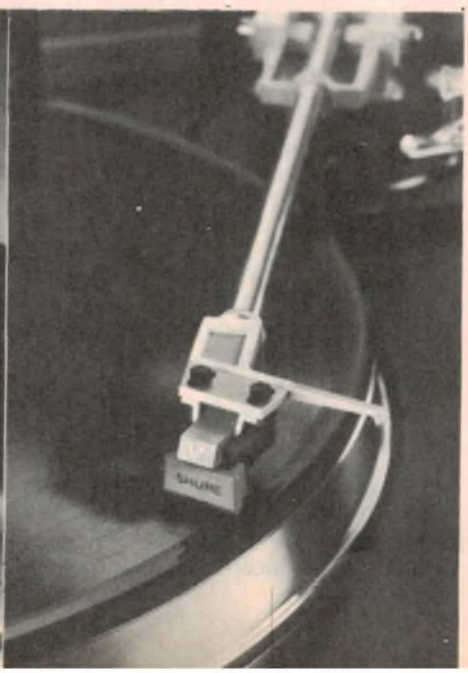


Refining the ultra-refined, Shure Bros. have now released the Model V-15 Type V-MR. The "MR" stands for "micro-ridge", Shure's new stylus tip geometry which is claimed to minimise distortion and record wear.

To anyone who has not purchased a quality cartridge for a few years, buying the new Shure V-15 Type V-MR is certain to be a satisfying experience. You don't just get a cartridge locked into some fancy but useless plastic package. Instead, Shure has put together a complete installation package which will enable the user to get the very best from his or her purchase.

Shure's alternative to a useless rosewood box or solid block of perspex is a rather strange oblong package with a "technical look" about it. Taking the lid off is a bit gimmicky – it's a bit like getting one of those childproof pill containers uncapped. You rotate this circular recessed knob and the lid unclips to reveal the cartridge and other bits.

Actually the cartridge is mounted in a thoughtful way, as pictured at the top of the page. The cartridge body is held by a saddle-clamp arrangement while the stylus assembly is secured in a separate holder. This is a good idea because it minimises the chance of damage to the delicate stylus assembly while the cartridge body is unbolted and mounted in the tonearm headshell.



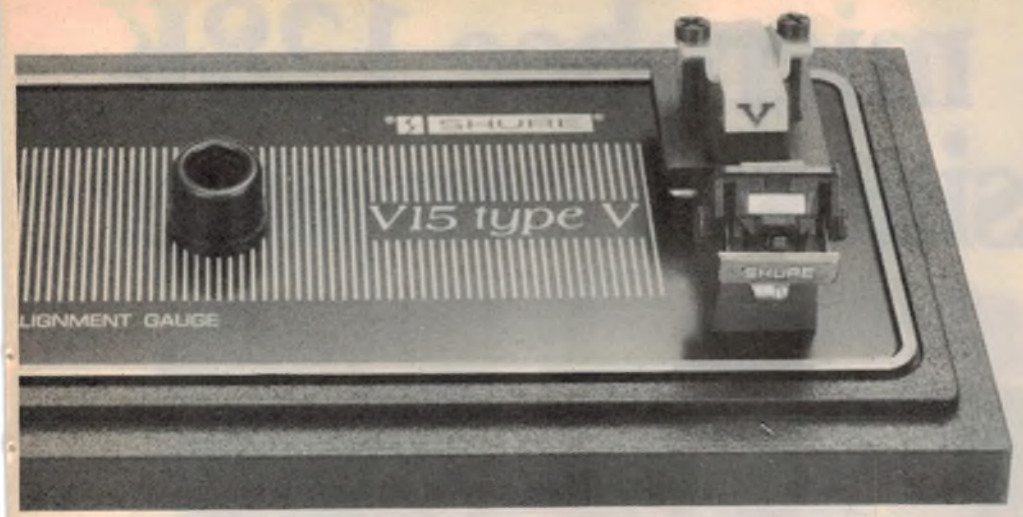
It turns out, when you detach the cartridge body from the baseplate, that the baseplate itself is an integral part of the installation kit. It is Shure's duo-point alignment gauge. This is used to align the cartridge correctly for minimum tracing distortion.

Normally this is done by first making sure that the cartridge is mounted parallel to the headshell centre-line (which is difficult since headshells do not carry guide marks) and then sliding the cartridge back or forth to get the correct stylus overhang (over the turntable spindle). This last step can also be difficult with some tonearms which will not move all the way to the centre of the platter. Shure has a different and better approach with its duo-point alignment gauge. Shure has found that if the cartridge is aligned so as to be tangential to the record groove at radii of 66 and 120.7mm, minimum tracing distortion results.

The duo-point gauge meets these criteria. Interestingly, when the cartridge is set with the guage it may well be quite out of square with the headshell.

The installation procedure is as follows: First, detach the cartridge body and mount in the tonearm headshell. Shure supply a range of plastic screws and matching soft plastic nuts which slide into key-ways on the cartridge body. These go some way towards making the task reasonably straightforward but when all is said and done it is still a fiddly job when you're all thumbs and shaky.

Then you insert a dummy stylus into



the cartridge body and fit the headshell into the tonearm socket. Shure refer to the dummy stylus as the "Alignment stylus" and it is used to ensure that the cartridge body is correctly aligned (ie, square and parallel) to the record surface.

Ensuring that the cartridge is square-on to the record surface is the tricky bit. Most tonearms have a small screw adjustment to the socket which allows the headshell to be rotated slightly to achieve this. The rub is that it is often very difficult to shift this screw and make the adjustment. Shure provide an alternative in the form of plastic shims to pack up one side of the cartridge.

With that step complete, the duo-point alignment gauge comes into play. This is first placed with its centre holes over the turntable spindle. The cartridge fixing screws are loosened off and the cartridge body (minus the stylus) is pressed down into the special nest in the gauge. The cartridge screws are tightened and then the whole assembly lifted up and the gauge placed so that its elongated hole is placed over the turntable spindle. Again the cartridge is readjusted to bring the alignment mark in line with the spindle.

After that, the tonearm must be balanced and the tracking force set to 1.5 grams. This actually gives a stylus tracking force of one gram since the Shure stabiliser brush exerts 0.5 grams on the record surface. The brush performs three functions: removes dust particles from the record groove, conducts away static charges and damps out arm resonance.

This last factor is probably the most important since it enables quite ordinary tonearms to give a sterling performance with the Shure cartridge. With an undamped tonearm, small ripples in the record surface can excite the arm resonance and lead to quite drastic mistracking, to the point of groove jumping. With the Shure stabiliser brush in operating position such ripples are tracked without any problems.

In fact, we found the tracking performance of the Shure V-15 Type V-MR to be the best we have ever experienced. Whether Shure have modified the stylus suspension as well as the profile of the stylus geometry we do not know but it turned in a superlative tracking performance, all at an effective tracking force of one gram. In this respect, no other cartridge can touch it. The V-MR tracked all our test discs without problems.

The claimed frequency response was a little harder to verify. Shure include a computer-printed test sheet with each V-15 cartridge and the sheet for our sample showed the response to be within 1dB over the range from 1kHz to 20kHz. At first we could not get within coo-ee of that. Shure recommend a capacitive load of 250pF in parallel with 47kΩ but note that 100pF to 400pF capacitance will cause negligible change from the optimum. We found the opposite.

Unless the load capacitance due to the connecting cables and preamp load is close to 250pF or less, the frequency response will not be to specification. In fact it can vary by as much as 3dB, depending on where the electrical resonance is placed by the shunt capacitance. Within that constraint, the Shure cartridge came very close to having a response within 1dB from 20Hz to 20kHz.

On the other hand, we had no great difficulty in confirming the printout figures for separation between channels: 26.5dB left channel and 32dB right channel, at 1kHz. The equivalent figures at 10kHz were 24.7dB and 21dB. Nowhere was it less than 15dB. Cartridge waveform was good, particularly on square waves where it was near perfect.

Okay. So what did it sound like? Quite simply, it sounded superb. There was no question that it was and is, one of the finest, if not the finest, cartridge available. In every respect, the Type V-MR performs flawlessly. On strings it is very sweet, without overdoing it in the slightest and it is smooth and very defined in bass regions too. What more can we say?

Unfortunately, the Type V-MR does not come cheaply. Recommended retail price is $576 while the replacement stylus is $260. Further details can be obtained from high fidelity retailers or from the distributors, Audio Engineers Pty Ltd, 342-344 Kent St, Sydney. (LDS).

NEW RELEASE

microbee 128K Small Business Computer

microbee

"microbee is the biggest success story of Australian computer design and manufacture"

Now just released, **microbee 128K dual drive Small Business Computer**, priced at only $2245 with popular programs from the world's best known software houses and a friendly 'user interface', appealing to beginners and experts alike.

A total package deal for the serious computer user, the **microbee** SBC comes with world class software such as WORDSTAR (accounts for 50% of the Australian wordprocessing market), MicroSoft MULTIPLAN (The 3rd generation spreadsheet), MicroSoft BASIC, and the powerful MICROWORLD packages such as TELCOM 2 (networking to other computers either directly or through a MODEM), Disk BASIC and Disk WorkBee.

The special user interface called 'B-Shell' allows the use of industry standard software, while being much 'friendlier' than most CP/M systems. 'ICONS' are used to select commonly used programs. INIT and TRANSFER programs simplify 'housekeeping' function. A comprehensive HELP system is also supplied.

The CP/M 2.2 operating system fully utilises the capabilities of the 128K SBC. Automatic disk caching increases program speed by 50%. 'M-drive' software allows 65K of RAM to be used as a fast disk. SETDRIVE allows other disk formats such as KAYPRO, IBM, OSBORNE to be read.

In its review of the leading Australian computer manufacturers in October 1983, Australian Micro Magazine claims:

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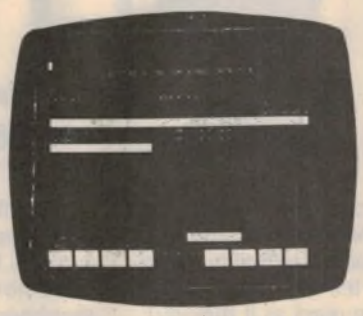

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Operating system	CP/M 2.2 with M/drive. Disk caching
User interface	B-Shell
Wordprocessing	WORDSTAR 3.3
Spreadsheet	MULTIPLAN 1.05
Accounting, Pay Roll etc.	SYBIZ Business Package
BASIC	MICROSOFT. MICROWORLD
PCG high res. graphics	512 by 256 pixels
Communications	TELCOM 2
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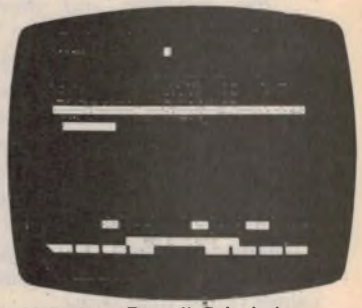
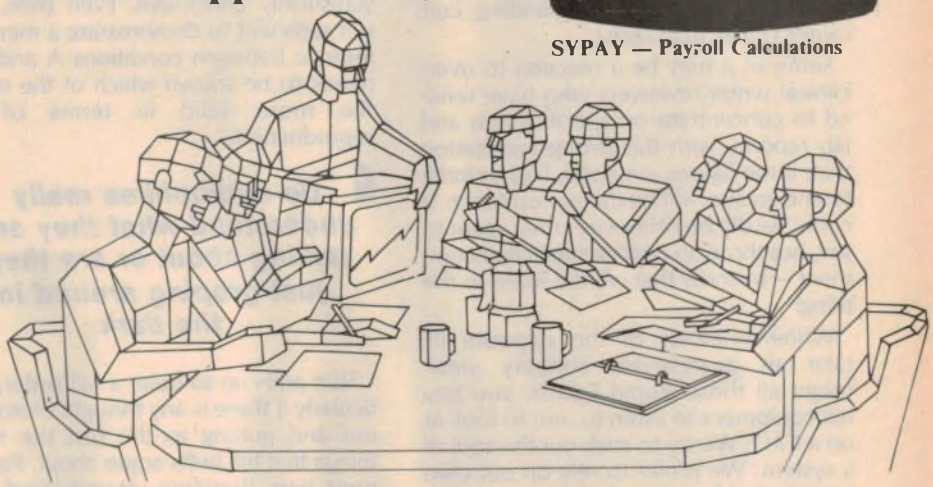


SYPAY — Payroll Calculations



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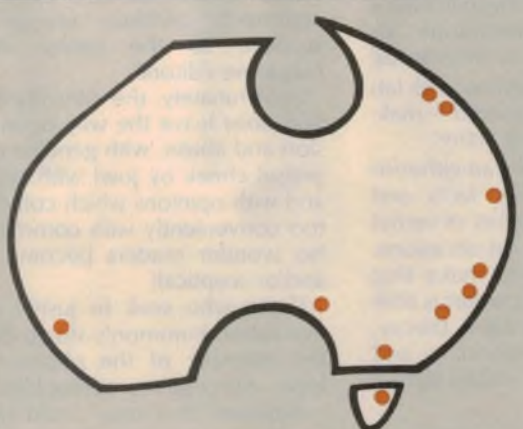

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It's enough to turn a bloke into

Fair dinkum! Some of the articles being published these days in overseas hifi magazines are over the odds. They are expressed in language so emotive and so extravagant that it discredits the very points the respective writers are trying to make. As a result, one tends to note the articles while rejecting them as the stuff of which agnostics are made.

FORUM

Conducted by Neville Williams

I am aware, of course, that the term "agnostic" normally carries a religious connotation but my dictionary assures me that, in a more general sense, it can also describe one who asserts:

"... the relativity and therefore the uncertainty of all knowledge."

It would not be too difficult to end up in that frame of mind after looking over some of the items in recent hifi magazines. Where does the truth lie amongst all the extravagant claims, the speculation and the controversy. Do audiophiles really understand what they are talking about or are they just groping around in the dark; expounding cult values rather than facts?

Some of it may be a reaction to over-clinical writer/reviewers who have tended to concentrate on specifications and lab reports, with the strong implication that, if the figures are good, bad or indifferent, so also will be the performance. It could hardly be otherwise, they seem to say, but throw in a bit of subjective comment – to show that we did listen to the thing!

Writer/reviewers of the opposite ilk take an aggressively contrary view: forget all those stupid figures; you buy hifi equipment to listen to, not to look at on a CRO. We try to seek out the soul of a system. We prefer to rely on our own trained, golden ears to tell us whether the sound is truly magical, magnificent or mesmeric; musical, meritorious or modest; mediocre, murky or monstrous!

In this context, specifications and lab tests are downgraded or ignored – making a point and evening the score.

Personally, if I had to make an either/or choice, I'd rather interpret facts and figures than some of the flights of verbal fancy that one encounters on occasions. But I prefer not to have to make that choice; it is much better if a writer is able to assemble all the evidence – theory, measurement and observation – and present it in a reasonably matter-of-fact way.

Laboratory measurements have the advantage that they can be standardised, can be used to specify performance parameters, and can be verified by anyone having the necessary equipment. They acquire a basic credibility as a result. But do they tell the whole story? Unfortunately, some react as if they did; realistically, they should be seen as valuable objective evidence, to be considered alongside subjective impressions.

The problem about subjective opinion alone is that, while it can be (and often is) expressed with great conviction, it cannot be substantiated by anything short of double-blind testing, carefully set up, independently controlled and statistically conclusive. Even then, it is not sufficient to demonstrate a mere difference between conditions A and B; it needs to be shown which of the two is the more valid in terms of hifi reproduction.

> ***"Do audiophiles really understand what they are talking about or are they just groping around in the dark"***

That adds up to quite a tall order, particularly if there is any thought of singling out and putting to the test the many things that hifi buffs argue about. For the most part, therefore, double-blind tests remain in the "too-hard" basket and the arguments continue unresolved – I suspect, to the secret delight of magazine editors!

Unfortunately, the difficulty of verification does leave the way open to confusion and abuse, with genuine critical appraisal cheek by jowl with self-delusion and with opinions which coincide rather too conveniently with commercial gain. No wonder readers become confused and/or sceptical!

Those who seek to justify subjective evaluation commonly do so by quoting the example of the phono turntable: how perceptive audiophiles stoutly maintained that they could hear a difference in the "sound" of quality turntables, even though engineers kept insisting that the units were virtually identical in their essential properties: speed and speed regulation, wow and flutter, rumble, hum field radiation and so on.

Did not the boffins ultimately discover that sound quality was indeed being affected by acoustic feedback from the loudspeakers to the cartridge by way of the turntable, the mat and even the disc itself? Did they ultimately not have to admit that we (the golden-ear set) had been right all along?

While I suspect that the tale of the turntable may be somewhat over-simplified, I would nevertheless like to draw a couple of points from it:

Firstly, subjective observations did lead to a logical technical explanation and to methods by which the effect could be displayed and evaluated in the laboratory. It is reasonable to assume that other subjective observations should follow the same process, provided they are valid. A subjective observation which continues to defy any tenable explanation must itself remain suspect.

The other point is that, because one subjective observation has been verified, it does not follow that all the others are in some way validated. Each still has to be proved or disproved on its merits.

What brought all this to mind was an article by David Wren in the December '83 issue of the English hifi magazine "HiFi Today": "Absolute wire and Randall Research lead".

I gather that "Absolute" cable is intended for loudspeaker connections and, from the description, is rather like a jumbo-size flat TV ribbon. It contains a pair of 720-strand "high purity" copper conductors, each about 7mm in diameter, sheathed and held apart by cream-coloured PVC insulation, to form a flattish cable about 20mm wide. According to David Wren, it is much to be preferred to the well known "Monster" cable but, at £3.25 per metre, costs about the same.

Now I don't hold any special brief for Monster cable or for some of the claims that have been made for it, but the direct comparison and other remarks which followed, I found highly intriguing, to say the least.

an audio agnostic!

But first, the background:

It is a fact that resistance, capacitance and inductance in loudspeaker leads can absorb audio power or otherwise affect operation of the system. Conventional wisdom is to use a twin pair to each loudspeaker (so that inductive effects tend to cancel), not too closely spaced (to limit capacitance), not too thin (to limit resistance) and certainly no longer than strictly necessary (to limit all three).

As a rule of thumb, it is commonly accepted that the DC resistance of the leads and connections should not exceed 5% of the DC resistance of the loudspeaker system. Depending on the cable run, this requirement might be satisfied with the thickest available lamp cord but it is preferable to seek out

"Because one subjective observation has been verified it does not follow that all others are in some way validated"

heavier gauge twin cable intended for automotive use, or produced expressly for loudspeaker connections. With that kind of lead and a normal domestic 8 ohm system, losses are generally reckoned to be negligible.

However, acting on the professed opinion that "negligible" isn't good enough, a number of companies have marketed deluxe loudspeaker cables – usually at a "deluxe" price. And, lest prospective purchasers be left in any doubt as to their possible merit, they are commonly credited in publicity material with producing a quite startling improvement in sound quality – a claim that sits oddly alongside the supposedly "negligible" losses occasioned by less pretentious (and less costly) cable.

To kill or to over-kill; that is the question!

While I have kept my money in my pocket, I will say this: with its heavy multistrand twin conductors, Monster cable should be able to impart to a hifi system whatever benefits might accrue from the use of extra-low resistance loudspeaker cables. I seriously question how much scope would be left for still further subjectively significant improvement.

But David Wren has no such reservation.

Based, presumably, on subjective judgment and the memory of what the cables sounded like before he changed them over, the improvement with "Absolute" cable was described as "immediate and worthwhile". This held true, so he says, with loudspeaker runs as short as two metres.

Come on now! Two metres?

While one should not, perhaps, defile subjective judgment with talk of mathematics, it would be an interesting exercise to work out the magnitude of the DC resistance, AC resistance (including skin effect), inductance and capacitance involved in two metres or ordinary heavy-duty loudspeaker cable, of Monster cable, and of Absolute cable. Then, having done so, to note the differences between them and to form some judgment as to their possible effect on system behaviour when feeding a load with as much internal DC resistance, AC resistance, inductance and capacitance as a domestic loudspeaker.

Nor do David Wren's further remarks alleviate my problem in accepting his verdict. On the contrary, they add to it. He says:

Against the Monster, for instance, Absolute wire is far lower in coloration. Monster has a certain "plummy" thickness which tends to rob the sound of attack and clarity. The Absolute wire has better bass extension coupled with greater definition throughout the bass and mid frequencies. Couple this with more open, sparkling upper mid and you have a far more airy, ambient sound stage and a greater sense of presence.

. . . the cost of Absolute wire can be justified in the most modest of installations.

Taken at face value (how else should they be taken?) those remarks claim a clearly audible advantage for Absolute cable in terms of overall sound quality, over most of the audio spectrum, and a freedom from the "plummy thickness" that allegedly characterises Monster cable.

As I said before, without holding any brief for Monster cable, I know of no technical reason why it could possibly impart a "plummy thick" sound to a typical hifi system and I know of no reason, either, why a competitor's cable should not only obviate the plumminess but impart an all-round improvement in quality as per the description – even with a cable run as short as two metres.

It would be a pity not to conclude David Wren's final pronouncement on Absolute loudspeaker cable:

It interferes less with the signal than any other, allowing through more of the wanted information naturally, with less of the crunge.

Crunge? What's crunge?

Don't know, old boy, but it sounds monstrous. Must take steps to get rid of it . . . Absolutely!

At this point, I can well imagine an august audiophile somewhere, leaning back in his leather chair and fixing me with eyebrowed stare and the stem of his briar pipe:

"You seem to have forgotten one thing: Absolute cable is directional and that can make all the difference!"

In fact, I haven't forgotten it; I simply wanted to talk about it separately.

When I first read about directional cables, I looked at the date of the magazine to check whether it happened to be the April issue. Surely it was a gag? But no; the writer appeared to be deadly serious; almost breathlessly so.

Listening tests had verified, he said, that there was a right way and wrong way to feed audio signals along connecting cables. Swap the cables around, and you could hear the difference. Taking advantage of this discovery, certain cables were being marketed with the input and output ends clearly marked. They must be installed so that the signal travels from input to output.

Going a step further, someone – I think it was someone else – referred to the practice as "sexing" cables, a term that seemed quite odd until I remembered

"Crunge? What's crunge? Don't know, old boy, but it sounds monstrous. Must take steps to get rid of it . . . absolutely"

that, for decades, the industry has been specifying male and female connectors of one kind and another.

Tut, tut!

That first explanation of directionality seemed to rest on the idea of an audio signal moving, as some kind of an entity, from point A to point B. It suggested that the writer's technical knowledge extended about as far as a simplified block diagram, drawn with arrows to show signal routing through a system. That's about all the arrows do show!

What is actually conveyed by signal cables is an electrical current – and not a direct current, at that. It is an alternating current which is all the time reversing its direction of flow at an audio rate. If the proponents of the directional cable concept are going to convince this writer, for one, they will need to start off with a more credible explanation of what they're on about.

A cable is directional in respect to what?

But that's only the beginning. I may have missed it, of course, but I have yet to come across any responsible technical

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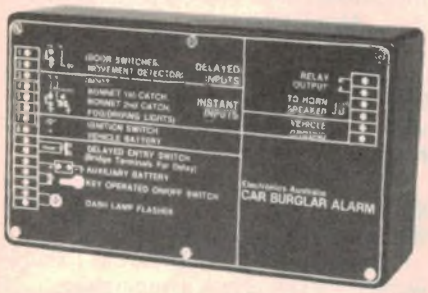

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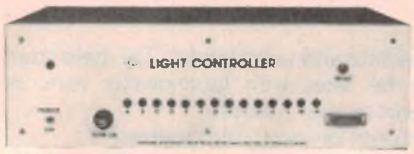

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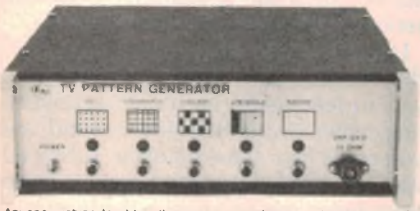

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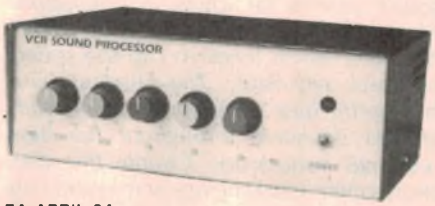

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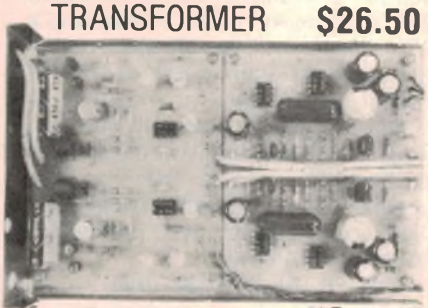

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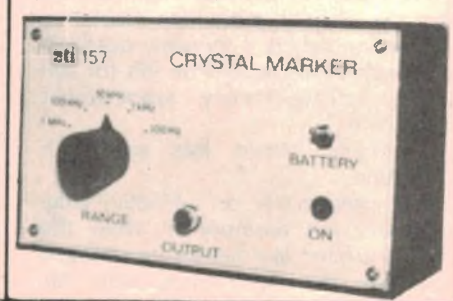

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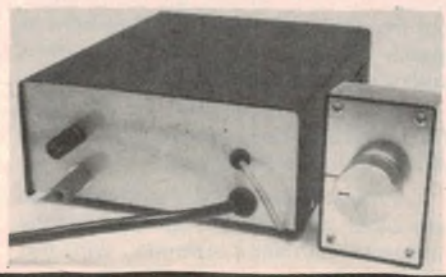

speculation as to how a cable gets to be directive in respect to whatever it's supposed to be carrying! At best, one finds broad references to the molecular structure of metals, impurities, semiconductor effects, and so on, leading to the assertion that, one of these days, the reason will emerge why signals travel better through wire this way, rather than that way.

In the meantime, they just do!

The fact of the matter is that, over the past several decades, there has been urgent, concentrated world-wide research into solid-state physics that has added enormously to our knowledge of material and current flow and spawned a huge array of components. But there has been no hint from that source, that I know of, of anything that would support the idea of directionality in signal cables.

And what of the cable manufacturers themselves? It seems strange that, after a century or more of producing cables for all manner of things, including audio distribution for some very discerning users, the discovery of supposed directivity in respect to analog audio signals should be left to an in-group of audiophiles using a mere few metres of connecting lead.

Is the property incidental to production – which way the metal is drawn through the dies, for example? Does the degree of "directionality" vary from batch to batch? How do the makers of Absolute and other "directional" cables determine which way round each individual batch should be made up for sale? By the way it is spooled? By some sort of electrical measurement? By golden-ear "testing"?

These are logical questions and it is not too much to expect logical answers before reaching for one's cheque book – sorry bankcard! The desirability of adequate, well-made, well-insulated, well terminated cables I understand. The need for good connection arrangements I understand. The merit of gold-plated contact surfaces I understand.

But directionality? I have yet to be enlightened.

Unfortunately, David Wren's article isn't of much help in this respect either. He seeks to bolster the case for the subjective evaluation of audio signal cables by injecting into the middle of it the now customary reference to the sound of turntables, referred to earlier. He observes:

". . . But nowadays most people realise there are great differences to be heard, even if they can't be measured."

It's a pity to have to spoil a good story but, as I have pointed out, the effect has long been identified as having to do mainly with acoustic feedback from the loudspeakers, through the turntable, etc, to the stylus. It has been set up in labs, observed on CRO screens, photographed, plotted, written about in technical magazines and thoroughly digested. It is one of the problems which CD players are credited with having eliminated.

The actual statement about cables reads thus:

"Now I know that many people still dismiss sonic differences in cables as being all in the mind – if you can't measure a difference it's not there, is it? . . . Ask any computer or long distance telecommunications engineer and you'll find they're quite clued up on cable technology and such aspects as to how twisting wires and material purity, insulating materials, etc, can influence results. It's not black magic to them."

"It seems strange that the discovery of supposed directivity in cables should be left to an in-group of audiophiles"

There's only one thing wrong with the above statement: it doesn't support the writer's case!

Many people still dismiss sonic differences in cables, etc: Correct; and they'll continue to do so until they're given a credible reason to think otherwise.

Computer and long distance telecommunications engineers are clued up about cables, etc. Correct again. Technical handbooks have multiple chapters on cables, transmission lines, etc. Libraries have multiple textbooks on the subject. Engineers specialise in aspects of it. But, because they are so "clued up", I would expect them to be the hardest people of all to convince about anything out of line with theory.

The purveyors of deluxe and directional cable would have it made if they could only find someone from that area able to produce a rigorous engineering paper validating their claims. It would be a sensation.

Until that happens, you'll just have to accept somebody's unsupported word for it all – or else acquire some very special equipment of your own. As David Wren puts it:

"All you need, dear reader, is a pair of receptive ears!"

Is that all? No, I would like to add one further observation.

I am no longer taken aback by references in the super cable case to twisted leads, skin effect, insulation, Litz wire and other ideas borrowed, rightly or not, from radio frequency technology but I was not prepared for a letter in the February '84 issue of "Hi-Fi News & Record Review".

A Mr D. Swann of Leeds, Yorkshire, professes to have tried and proved something that would presumably outperform either Monster or Absolute cable. They both use copper as the conductor and therein lies the problem.

Prompted by an earlier reference in the same journal, Mr Swann connected his Wharfedale Linton loudspeakers to the amplifier by means of lead tubing and lead wire. He appears to be particularly impressed by the lead tubing because even lead wire is slightly compromised by the insulation which wraps the surface along which the audio signal travels.

Says Mr Swann:

"I compared my Lintons after I had tubed them with PWB lead tubes and the difference was audibly much better; as good, in fact, as changing for better speakers."

As an audio cynic and an audio agnostic from way back, I can't help but indulge in the following imaginary scenario:

Mr D. Wren, the "Absolute" champion, questioning the opinion of Mr D. Swann and being politely told:

"All you need, dear David, is a pair of receptive ears!"

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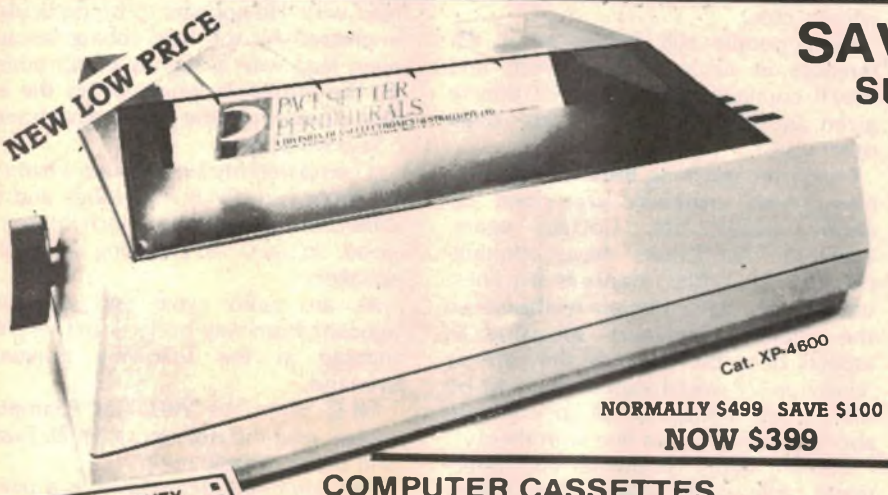

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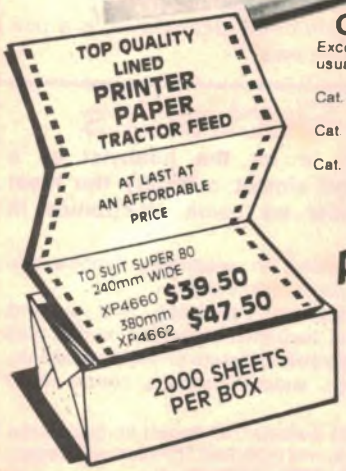

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ETI644A See ETI Jan '83!!

DIRECT CONNECT MODEM

Ref. ETI October 1982

Two models (i) Short form which contains ALL PCB components as specified by ETI (BEWARE!!). The genuine ETI PCB with plated-thru holes, solder mask and component overlay is supplied. We also supply at NO EXTRA CHARGE a full set of quality IC sockets. A must with plated-thru PCB - remember this when making comparisons.
(ii) Full kit includes : all of the above plus 12V plug-pack, case, switch and LED bezel and Cannon DB-25 RS-232 connector. Makes a complete stand-alone modem. ● Capable of a range of Answer/Originate operating modes ● Selectable Baud rate ● Software controlled ● Uses new patented technique ● More reliable and faster than most acoustic modems.
Arlec transformer as used in this project only $22.00

NEW MODEL

SHORTFORM KIT Cat. KE-4600 **ONLY $169**

COMPLETE KIT Cat. KE-4601 **ONLY $199**

ONLY $59.95 NEW

JOYSTICKS

These quality units are the self centering type with heavy duty suction cups which definitely keeps it in place. It has silver plated switch contacts, a pistol grip and is super responsive.

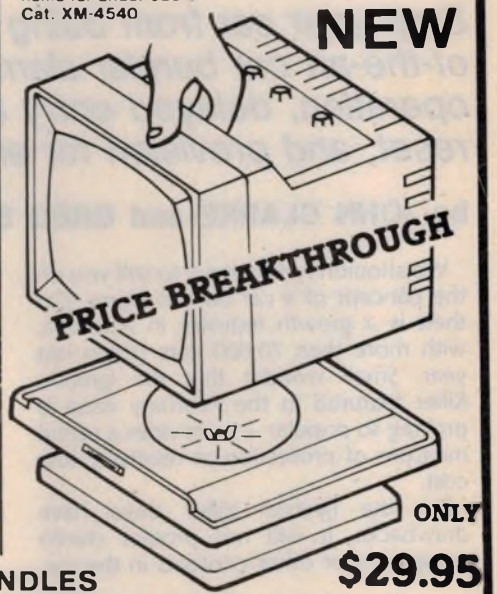
Cat. XA-5630 without plug **$19.50**

Cat. XA-5610 suit MicroBee **$29.50**

TILT-BASE FOR MONITORS

Now you can mount your monitor on a swivel/tilt base to maximise the viewing angle (and reduce glare) of your computer monitor.
Until now tilt bases were expensive or only fitted to expensive monitors. Now you can have one in your home for under $30!!!
Cat. XM-4540

NEW



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Fantastic price breakthrough. A must for serious P.C. users. Will take up to 50 x 5¼" floppies in sets of 10. Compartments lift up and lock in place for easy identification of disk files. ABS resin case. Dimensions: 400mm long 180mm wide by 170mm high. Translucent plastic lid. Quality!
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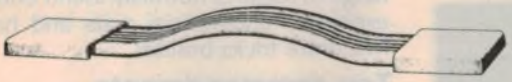
NEW! SPEAKER/EQUIPMENT CABINET FITTINGS

Jaycar has expanded its range of hardware for road cabinets, speaker and other equipment enclosures.

HEAVY DUTY STRAP HANDLES

Overall length 250mm. Will lift a maximum weight of 50kgs! Ideal for speakers, amps, etc. English made.
Cat. HS-8020
ONLY $5.95



HEAVY DUTY BAR HANDLES

Very robust design where strength coupled with an airtight design is desirable. As used in "Marshall" amps. Cutout hole size 119 x 221mm.
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$11.95 10 up $10.95 ea

PLASTIC LOCKING CORNER PIECE

Heavy duty plastic moulded corner fitting featuring male/female inserts. These are designed to fit together so that pieces of equipment (the same size) can stack up and lock together. Ideal for speaker boxes.
Cat. HM-3826
ONLY $1.75 ea 10 up $1.55 ea

PLASTIC FOOT

Moulded in tough yet resilient plastic. Enables you to slide heavy equipment across most floors without damaging the floor. 37mm diameter, one screw fixing.
Cat. HP-0830

1-9 **60¢** 10 or more **55¢**

METAL CORNER FITTING

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Cat. HM-3822 (Not illustrated)
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SON OF CHEAP VIDEO

This sequel to *The Cheap Video Cookbook* provides a complete video display system which you can build for as little as $7. Likewise, transparency display can be created for under $1 by using a video circuit called "The Snuffler" which is completely described in Chapter 2. This book makes cheap video even cheaper!
224 Pages. 5½ x 8½, soft.
Cat. BS-0604 ..... **$15.95**

Keep thieves at bay: install our new

Deluxe Car Burglar Alarm

Stop your car from being stolen. This new state-of-the-art car burglar alarm features keyswitch operation, delayed entry and exit, automatic reset, and provision for an auxiliary battery.

by JOHN CLARKE and GREG SWAIN

We shouldn't really have to sell you on the concept of a car burglar alarm. Car theft is a growth industry in Australia, with more than 70,000 cars stolen last year. Small wonder that the Ignition Killer featured in the February issue is proving so popular – it provides a useful measure of protection at relatively low cost.

But the Ignition Killer does have drawbacks. It will not protect stereo equipment or other contents in the car, nor does it have an alarm to frighten the thief away. And while it will fool most joyriders, it will not stop a determined "professional" for too long.

By contrast, a properly designed and fitted car burglar alarm provides "front line" defence. It will sound an alarm if an attempt is made to gain access to the vehicle and this by itself is usually sufficient to deter the thief. Common practice is to add to the deterrent effect by fitting the vehicle with prominent warning stickers and a flashing dash panel lamp.

When we described the Ignition Killer project, we were quick to point out the drawbacks of many commercial car burglar alarms. In particular, we pointed out that many could be disabled simply by cutting the horn wires from underneath the vehicle or by disconnecting the battery.

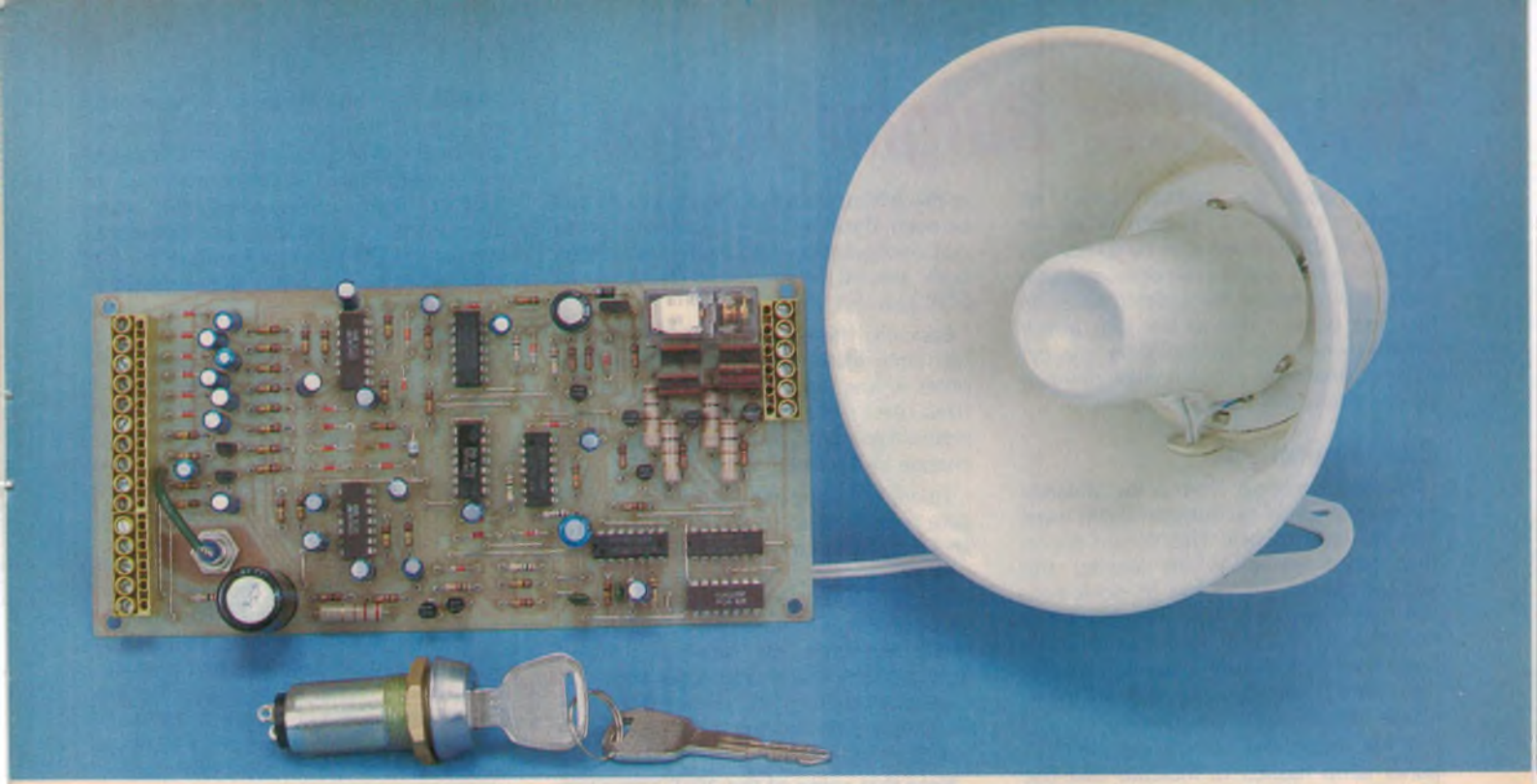
For sure, it's possible to install commercial alarms that will frustrate all but the most professional thief. The trouble is, they usually cost an arm and a leg. Most sell for between $200 and $400 fitted although there are units that you install yourself for around the $100 mark.

The unit described here will set you back no more than about $70 but that's not to say that it's a cheap and nasty design. On the contrary. It includes a range of features normally found only on expensive commercial units and has a few more tricks besides.

Ten commandments

What features should be included to produce an effective car burglar alarm? In the "Open Road" for December 1983, the NRMA briefly surveyed a number of commercial units and gave a list of "Ten commandments". Let's take a look at these:

1. The alarm should protect all doors, bonnet and boot at least.
2. It should operate instantly when the boot is opened and when the bonnet lock is released.
3. Air horns or a siren should be used, rather than the car's horn.
4. The alarm should be set from inside the vehicle or by an electronic key – not by a key or tumbler switch from outside the vehicle.
5. Entry delay should be between five and 10 seconds.
6. The alarm should cut out the ignition system.
7. If the alarm obtains its power from the battery, the wiring should be direct



and should be positioned so that it cannot be reached from under the vehicle.

8. Horns or sirens, and the wiring to them, should be placed so that they cannot be tampered with through the grille or from under the vehicle.

9. The alarm duration should be about two minutes, with automatic cut-out and reset.

10. Window stickers should indicate that the vehicle is carrying an alarm system, but not the make or type.

The NRMA survey covered some 27 different alarm systems. Of these, the best units only complied with the first eight conditions.

By contrast, this new EA design can meet all the above requirements except for the sixth. We'll have more to say about that later. Other features include a flashing dash panel lamp, keyswitch operation, an auxiliary battery (optional), and provision for tow-away protection. It can protect external driving lights and will instantly trigger if the ignition is switched on or if the leads to the car's battery are cut (provided, of course, that an auxiliary battery is fitted).

Inputs and options

The key to the versatility of this alarm is that the inputs are designed to detect a change of state. It does not matter whether an input is normally pulled low or tied high, or whether the input is open circuit. If there is any change on the input (ie, from 0V to +12V or vice versa), the alarm will trigger.

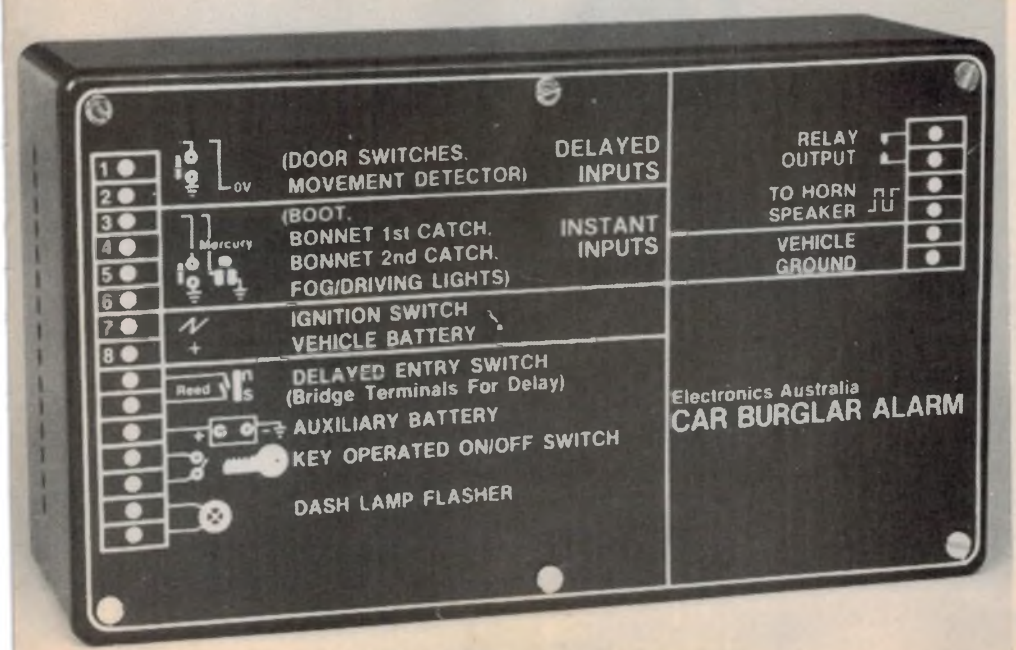
There are eight inputs in all, two providing 10-second delayed triggering and six providing instantaneous triggering. The delayed inputs monitor the doors and an optional ultrasonic movement detector (to be described later), while the six instant inputs monitor the boot, bonnet, external driving lights, ignition system and the vehicle battery.

When triggered, the alarm drives a separate horn-type loudspeaker for a period of two minutes and causes the hazard lights to flash on and off. At the end of the two minute alarm period, the unit automatically resets and rearms itself.

Several different techniques are used to trigger the alarm. The doors are protected by monitoring the courtesy light switches, the bonnet by fitting a spring-loaded switch adjacent to the bonnet catch, and the boot by fitting a mercury switch to the bootlid (a measure that also provides protection against tow-away). The ignition and battery inputs simply detect the presence or absence of voltage, while the driving lights are protected by monitoring the filaments.

There are other options. For example, some readers may prefer to forget about tow-away protection and monitor the bootlid by making a connection to the switched side of the bootlight. Other readers might prefer to protect the bonnet using a reed switch and magnet assembly. It's really up to the individual as to just how inputs 1-6 are used.

Below is the prototype alarm, ready for installation.



Deluxe Car Burglar Alarm

What about the ignition cutout requirement referred to earlier? While we did not fit this feature directly to our car burglar alarm, we do recommend that readers also install the Ignition Killer. In fact, we believe this to be a far better scheme since the Ignition Killer can act independently as a last line of defence should the alarm be disabled.

Easy operation

While it's nice to have a lot of fancy features, a good car burglar alarm must also be easy to use. This design meets that requirement. When leaving the vehicle, all the driver has to do is turn the alarm on using the key operated on/off switch. He then has 10 seconds to leave the vehicle during which time the dash panel lamp remains fully lit to indicate that all inputs are disabled.

At the end of the exit period, the dash panel lamp flashes to indicate that the alarm is armed.

Entering the vehicle is just as easy – for the driver, that is – although we have included a rather clever "wrinkle" in the delayed entry input circuitry. Essentially, the reader has two options.

The first option is to bridge two terminals on the alarm to provide for normal delayed entry. This gives the driver 10 seconds to open the car door and switch off the alarm. As before, the dash panel lamp remains fully lit during this procedure.

The second option is to fit a reed switch across the two terminals instead of linking them. The delay circuitry will now operate only if the reed switch is momentarily closed. If the switch is not closed, the alarm will trigger instantly when the car door is opened.

In practice, the reed switch can be glued to the inside of the windscreen immediately adjacent to the pillar or the dashboard. Or it could be hidden in the external mirror surround or some other suitable location. To enter the car, the driver simply uses a small magnet to momentarily close the reed switch. He then has 10 seconds to open the car door and switch off the alarm as before.

How it works

At first glance, the circuit may seem quite complicated, comprising as it does eight CMOS ICs, 14 transistors, 25 diodes and associated components. But while there may seem to be quite a few components, the circuit can be simplified by breaking it down into six basic sections: input circuitry, alarm timer, delayed exit timer, delayed entry timer, dash lamp flasher, and horn speaker driver circuitry.

The action starts with the eight inputs at the lefthand side of the circuit. As can be seen, these all have a fairly similar circuit configuration with each input circuit built around an exclusive-OR gate, or XOR gate for short.

Basically, the output of an XOR gate is high only when one input is high and the other is low, and is low otherwise. We have used this characteristic to derive a positive-going pulse whenever there is a change in the input state.

To achieve this, one input of each XOR gate is connected to the other input via an RC delay circuit consisting of a 100kΩ resistor and a 10μF capacitor. Thus, when the input signal changes state, one input of the XOR gate changes state immediately while the other is delayed from making this change until the 10μF capacitor charges to about 8V. The result is a positive-going 100ms output pulse.

Note that some of the 10μF capacitors are tied to the positive supply rail while the remainder are tied to ground. This was done to simplify the printed circuit board (PCB) layout and in no way alters the operation of the circuit.

Inputs 1-6 are all tied to the +12V rail via 100kΩ pullup resistors, while the 1μF capacitors provide decoupling to prevent false triggering. Normally, the trigger switches are open circuit and inputs 1-4 are held high. If a switch closes (as when a door is opened), the input is pulled low and the corresponding XOR gate produces a 100ms pulse.

Inputs 5 and 6 function in similar manner except that they are normally held low by the driving light filaments and are pulled high if the ground connection is broken. The corresponding XOR gate then produces a 100ms pulse as before. Diodes D1-D6 prevent damage to the XOR gates in the event that a positive voltage higher than their own supply is applied to the inputs.

Voltage sensing inputs 7 and 8 use transistors Q1 and Q2 to switch the inputs of XOR gates IC2d and IC2b between the high and low states. In the case of the ignition input (7), Q1 is normally off and the inputs to IC2d are high. When the ignition is switched on, Q1 turns on and pulls the input signal to IC2d low.

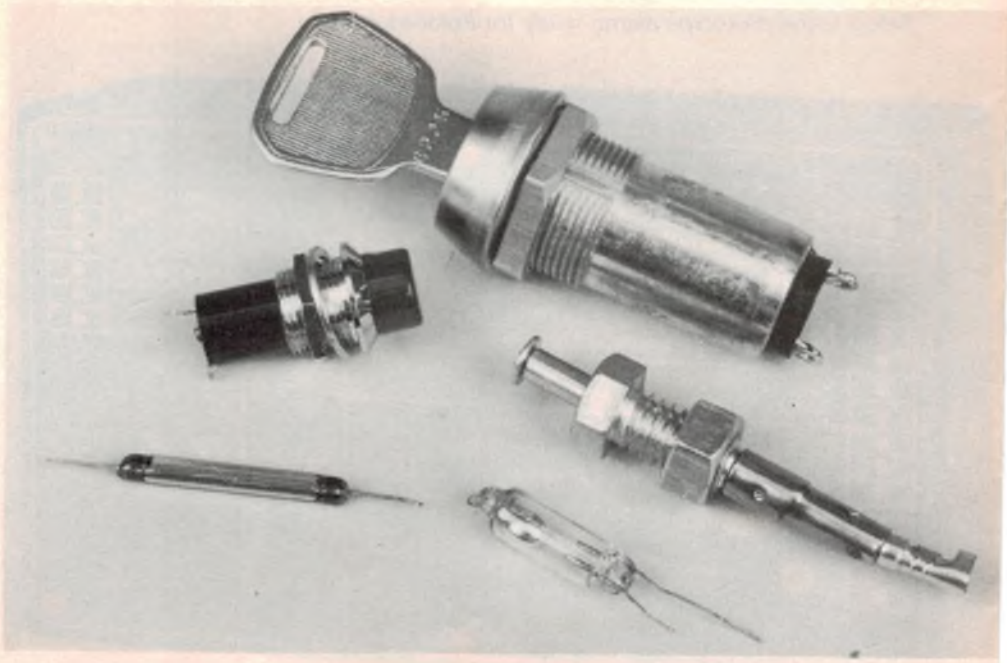
Q2 works in reverse fashion. It is normally biased on by the battery voltage but turns off if the battery leads are cut.

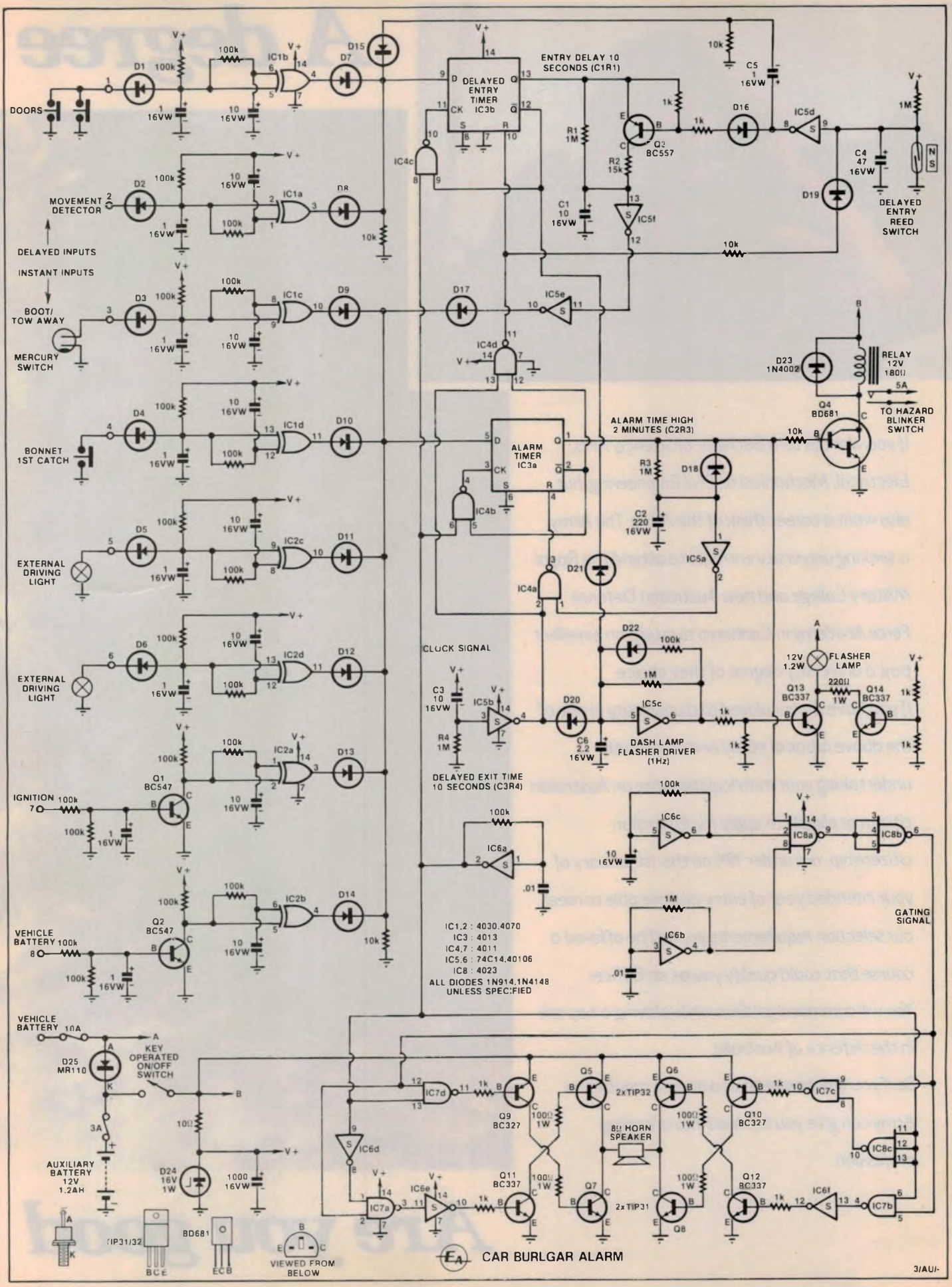
The outputs of IC1a and IC1b are fed to diode OR gate D7 and D8, and then applied to the data input of D-type flipflop IC3b. Likewise, the outputs IC1c-IC2d are connected to the data input of IC3a via diodes D9-D14. Note that both data inputs are normally tied low via a 10kΩ resistor.

Here's how this circuitry works. A D-type flipflop has two complementary outputs designated Q and $\overline{Q}$. When the Reset input is low, the Q output will follow the Data input at the positive edge of the clock waveform. In other words, if the Data input goes high, the Q output will also go high when the next positive going clock pulse is received.

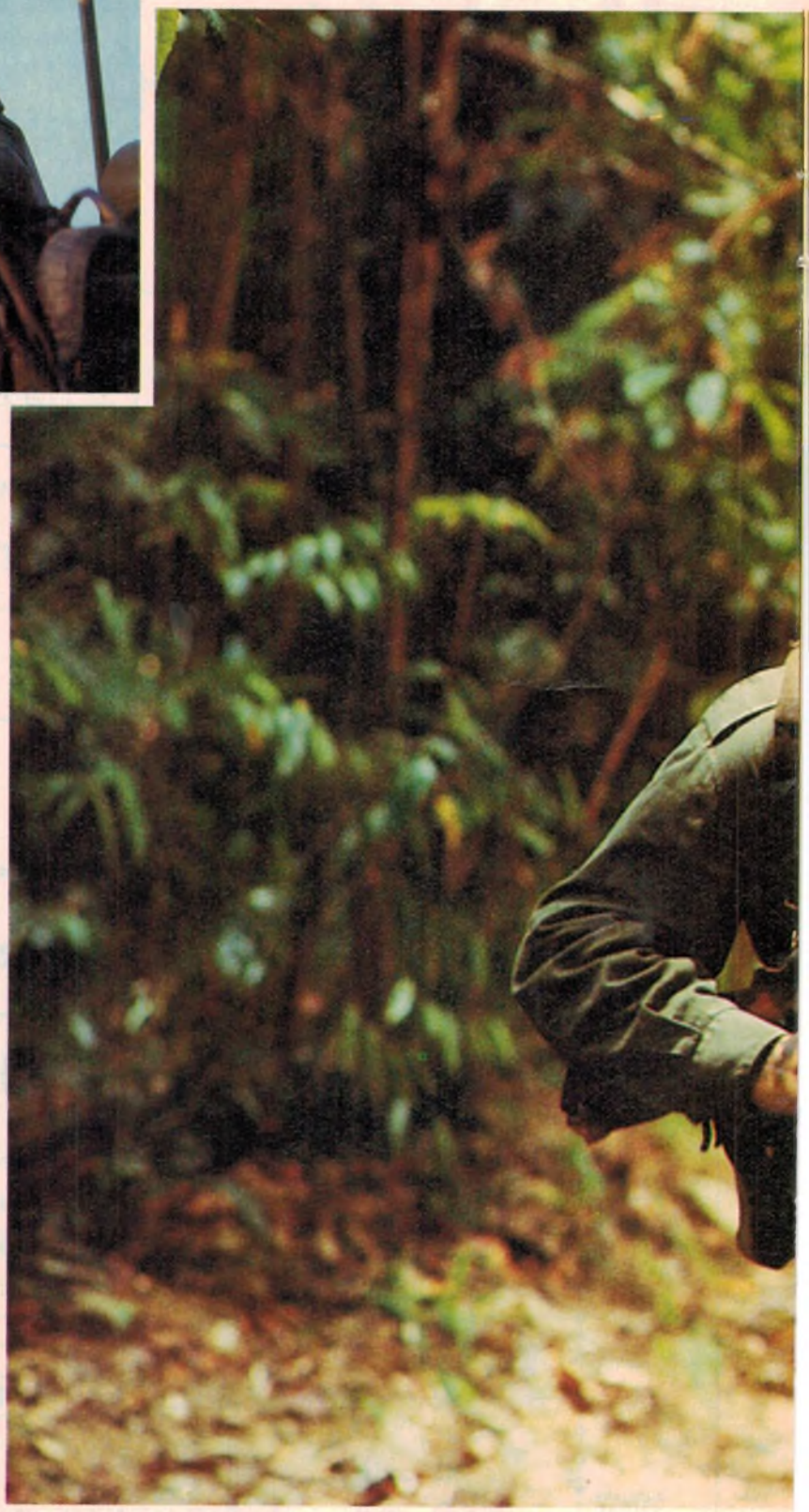
IC3a is the alarm timer. Its clock signal is gated by IC4b which has its pin 5 input connected to $\overline{Q}$. Thus, when $\overline{Q}$ is high, IC4b inverts the clock signal and passes it

Alarm accessories (clockwise from top): barrel-type keyswitch, spring-loaded automotive switch, mercury switch, reed switch and bezel lamp.




DOORS
MOVEMENT DETECTOR
DELAYED INPUTS
INSTANT INPUTS
BOOT/ TOW AWAY
MERCURY SWITCH
BONNET 1ST CATCH
EXTERNAL DRIVING LIGHT
EXTERNAL DRIVING LIGHT
IGNITION
VEHICLE BATTERY
DELAYED ENTRY TIMER IC3b
ENTRY DELAY 10 SECONDS (C1R1)
ALARM TIMER IC3a
ALARM TIME HIGH 2 MINUTES (C2R3)
CLOCK SIGNAL
DELAYED EXIT TIME 10 SECONDS (C3R4)
DASH LAMP FLASHER DRIVER (1Hz)
GATING SIGNAL
DELAYED ENTRY REED SWITCH
RELAY 12V 180Ω 5A
TO HAZARD BLINKER SWITCH
12V 1.2W FLASHER LAMP
IC1,2 : 4030.4070
IC3 : 4013
IC4,7 : 4011
IC5,6 : 74C14,40106
IC8 : 4023
ALL DIODES 1N914,1N4148 UNLESS SPECIFIED
VEHICLE BATTERY 10A
KEY OPERATED ON/OFF SWITCH
AUXILIARY BATTERY 12V 1.2AH
8Ω HORN SPEAKER
2xTIP32
2xTIP31
VIEWED FROM BELOW
CAR BURLGAR ALARM
3/AUI-

A degree



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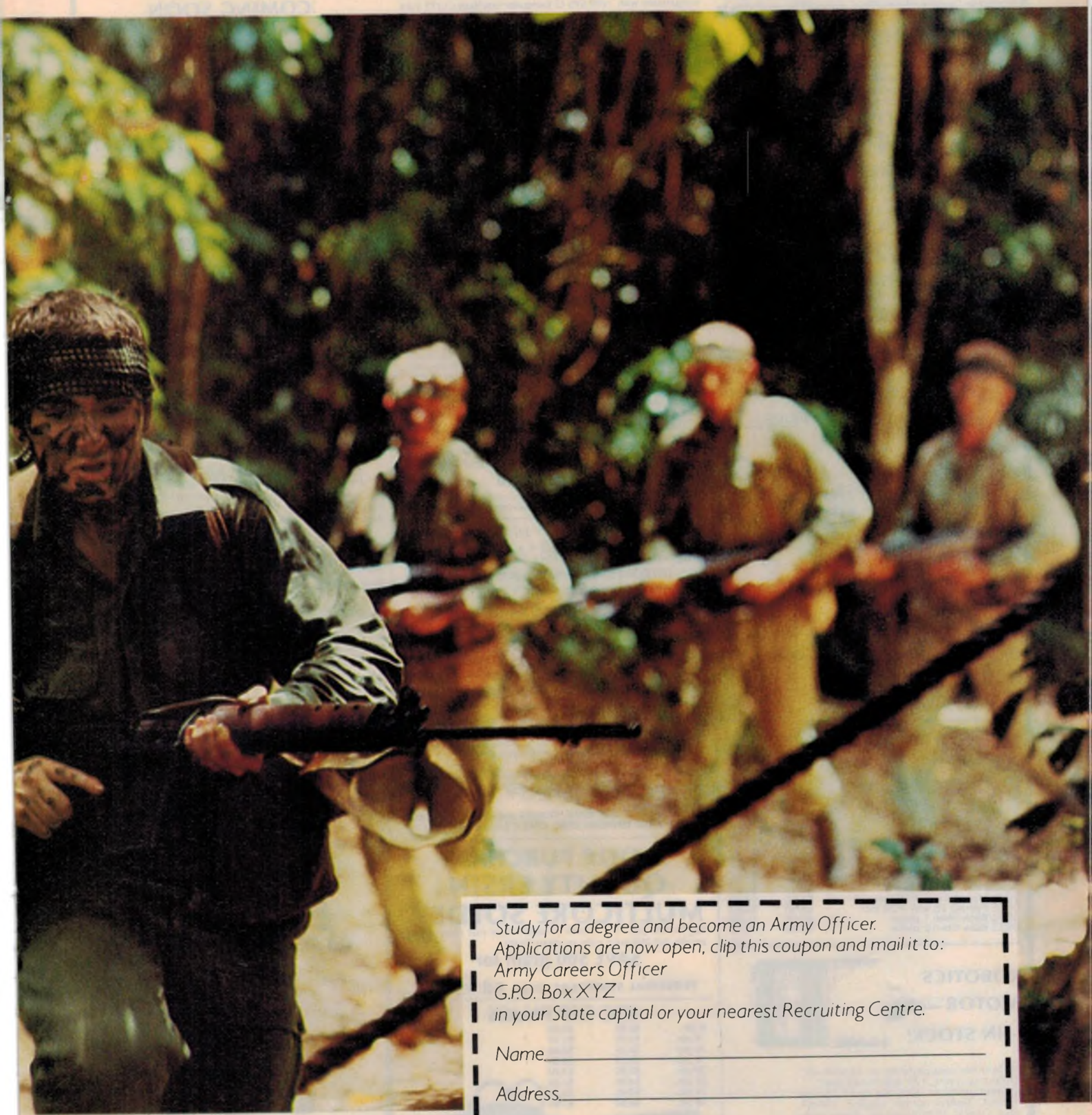
that leads to leading.



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enough?

AVTEK MULTI MODEM

The AVTEK MULTI MODEM is a completely Australian Designed and Manufactured Multi Standard Modem. It has been designed to meet current Telecom specifications (approval pending) and will be available in 4 different styles.

KIT FORM

This is for the hobbyist and is not approved for connection to Telecom lines. It is ideal for private line use and for the Amateur Radio operators for Packet Radio (See review Electronics Australia January 1984). Complete kit to the last nut and bolt including pre-punched and silk screened front and back panels.

ONLY
$249.00

MODEL MM2

This is a completely assembled and tested unit with a telephone hard wired into the Modem. It can be plugged legally into any phone socket to replace your standard phone.

INTRODUCTORY PRICE
$329.00

MODEL MM3

This is basically the same as model MM2 but does not include the telephone but comes fitted with a data Telecom plug which means a dedicated socket must be installed by Telecom.

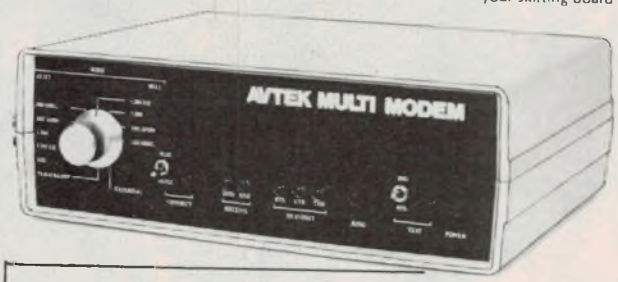
CONTACT AVTEK FOR PRICE

MODEL MM4

This unit is basically the same as model MM3 but does not have externally selectable Baud rate. The mode of operation is factory set. This is ideal for dedicated dial-up lines. This model also has hardware Auto Answer included.

CONTACT AVTEK FOR PRICE

SPECIFICATIONS FOR KIT, MM2, MM3 and MM4
☐ **Data Standards** CCITT V.21 & V.23, Bell 103 & 202 ☐ **Data Rates** 300, 600 and 1200BPS ☐ **Backward Channel** 75 BPS in conjunction with 1200 BPS ☐ **Computer Interface** CCITT V.24 (RS232C) ☐ **Power Requirements** 240V AC 3 watts ☐ **Front Panel Controls** Mode Switch (12 position rotary - not MM4), Connect switch (3 position toggle), Test Switch (3 position toggle) ☐ **Front Panel Indications** Connect LED, DCD Data Carrier Detect, RXD Received Data, RTS Request to Send, CTS Clear to Send, TXD Transmit Data, RING Ring Detect, TEST Test switch off normal, POWER.



NOTE: Models MM2, MM3 and MM4 will not be available until Telecom approval has been obtained.

COMING SOON
MINI MODEM

Possibly the smallest Telecom approved (pending) Modem on the Australian market - includes phone. 300 Baud CCITT answer or originate (switchable), plugs into standard telephone socket and replaces standard phone. So small it can be mounted on your skirting board near phone socket.

SPECIFICATIONS:
☐ 300 Baud CCITT answer or originate
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☐ Includes telephone with last number re-dial.

$189.00

MULTIPROM KIT - BACK IN STOCK

The Multiprom board is an extension of the Microbees memory in ROM. It simply plugs into the fifty way bus expansion port on the core board. It fits either neatly inside the Microbee or behind it, using the Microbee's own power supply.

The board takes the EDASM and NET eprom normally residing inside the Microbee, but allows several different sets to fit in: Editor-Assembler, Wordbee, Logo, MiniPascal, Networkrom, Bemon or your own program. It has room for 4 sets of eproms in the EDASM location and 3 sets of eproms in the NET location, a total of 44K of eprom. The board can be simply daisy chained with up to 6 slave boards (using an outside power supply in this case), allowing a maximum total of 308K in ROM. The EDASM locations accept either type 2532 or 2764 eproms and they can be mixed. Another powerful feature of the board is the input/output system. 11 outputs, open collector transistor driven. Each can turn ON or OFF a relay under program control. 8 inputs, buffered and protected can read 8 switch status - ideal for computer controlling of model trains, alarm systems, tape recorders, machinery etc.
The Avtek Kit includes a plated through board plus all components to make this exciting project. There is also provision on the board to change the address of the ports used for eprom selection and input/output.

ONLY $99.00

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DB25 Male 25 way PCB mnt	$4.50	$4.10
DB25 Female 25 way PCB mnt	$5.50	$5.00
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Size: Overall 55mm long by 35mm wide.
Shaft length 20mm and shaft diameter approx. 4mm.

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ABOUT 30% OF NORMAL PRICE
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THERMISTOR SPECIAL *56R Philips type 2232-660-91009 - refer to Philips Catalogue for specs.*
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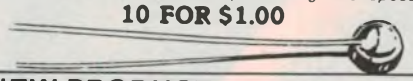

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22g in 500 gram rolls (that's ½ kilo!). Note that most other people sell 200 gram rolls for about $5.00.

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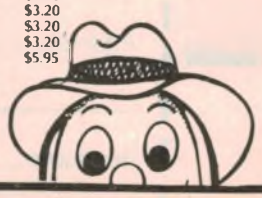

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EVERY DISC HAS EVERY SECTOR OF EVERY TRACK CERTIFIED 100% ERROR FREE!
5¼" Note double density can be used as single density.

Single sided/double density	$4.95
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NOTE: That these prices are cheaper than some people charge for inferior discs.

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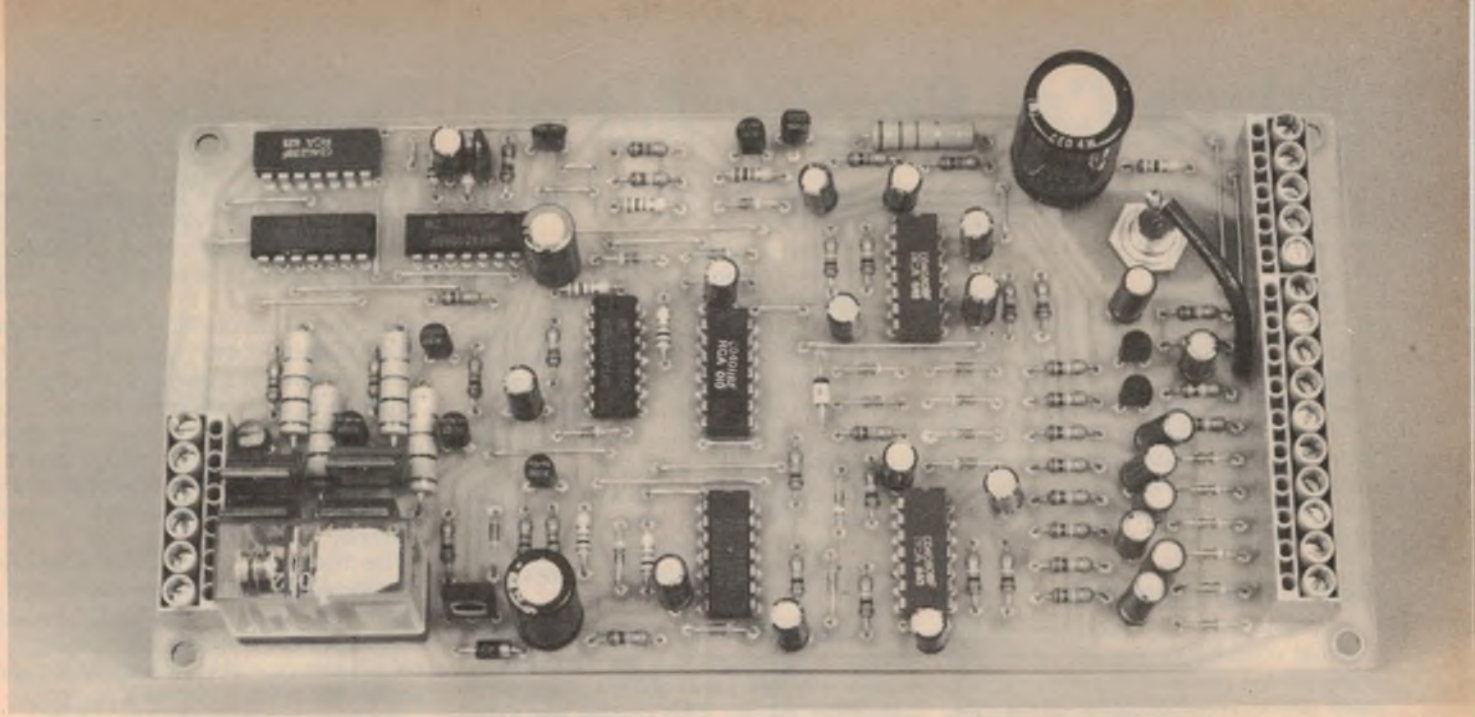


Deluxe Car Burglar Alarm

to IC3a's Clock input (pin 3). Now comes the tricky bit. When the Data input (pin 5) goes high (ie, when an input is triggered), $\overline{Q}$ goes low and the output of IC4b goes high.

What this now means is that the Q and $\overline{Q}$ outputs will not be affected when the Data input subsequently goes low after 100ms, since no further clock pulses can reach IC3a. The flipflop thus remains latched with Q and $\overline{Q}$ high and low respectively.

The high Q output of IC3a is used to gate on (via IC8a) the horn speaker driver circuit to sound the alarm. At the same time, it charges capacitor C2 via resistor R3. After about two minutes, the voltage across C2 reaches a level sufficient to switch Schmitt trigger IC5a to a low output.

Since pin 2 of IC4a is normally high, it follows that pin 3 of IC4a will also now go high. This resets IC3a to its normal state with Q low and $\overline{Q}$ high, thus switching off the alarm at the end of the two minute period. At the same time, diode D18 rapidly discharges C2, pin 3 of IC4a goes low, and pin 5 of IC4b goes high, thus allowing clock pulses through to the Clock input.

The circuit is now re-armed, ready for the next 100ms pulse on the Data input.

Note that if it were not for D18, C2 may not be fully discharged before the next trigger input. Depending on the circumstances, this could result in an alarm time that was considerably shorter than two minutes.

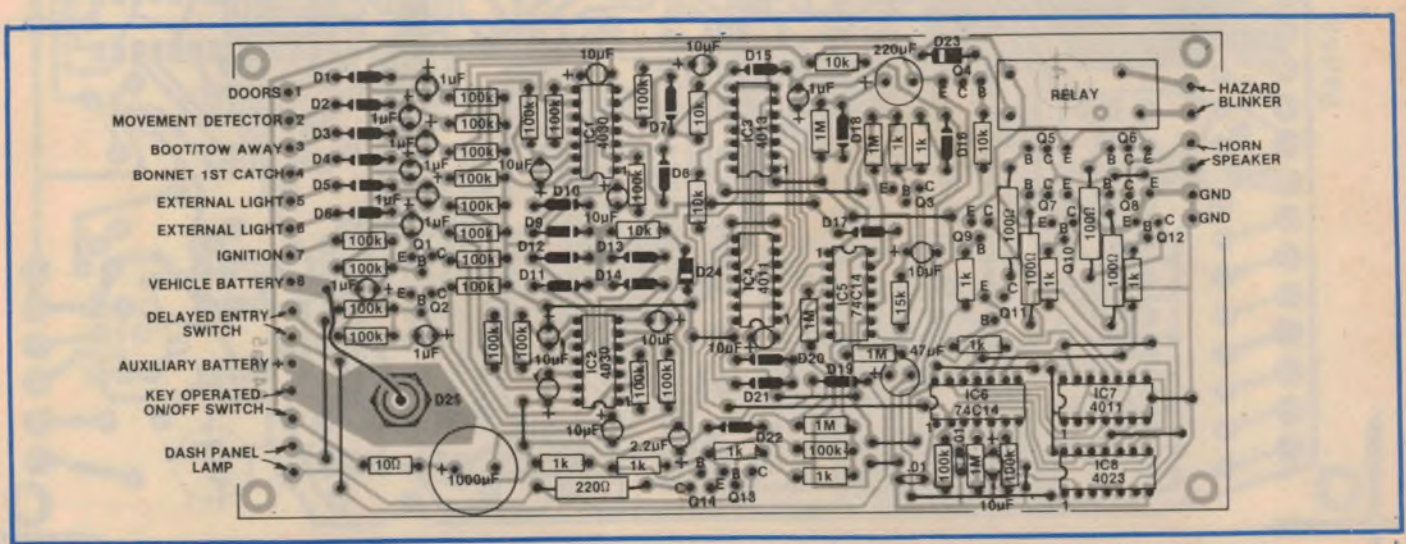
Delayed entry timer

IC3b is the delayed entry timer and functions in similar fashion to IC3a. Initially, Q is low, $\overline{Q}$ is high and clock pulses are gated through IC4c to the Clock input (pin 11). When a positive-going pulse is applied to the Data input, the Q output goes high and $\overline{Q}$ goes low to stop the clock pulses as above.

Assuming for the moment that transistor Q3 is off, C1 now charges via R1. After about 10s, the voltage across C1 reaches the trigger threshold of Schmitt trigger IC5f. The output of IC5e then switches high and applies a positive voltage to the Data input of IC3a which then functions exactly in the manner described above.

The result of all this chicanery is that the alarm again sounds for two minutes but only after a 10s delay.

IC3b is reset using IC4d. When $\overline{Q}$ of IC3a goes low, the output of IC4d goes high and Q and $\overline{Q}$ of IC3b are forced low and high respectively. IC3b is held in this state for the duration of the alarm time. At the end of the alarm time, $\overline{Q}$ of IC3a



Deluxe Car Burglar Alarm

switches high again and the output of IC4d goes low. IC3b is now re-armed and ready to accept the next input to its Data pin.

If that's all a bit too much for you, consider it this way. The delayed entry inputs trigger IC3b which in turn triggers IC3a after a 10s delay. During the following two-minute alarm period, IC3b is held in the reset state by IC4d and the $\overline{Q}$ output of IC3a. Finally, at the end of the alarm period, both Reset inputs go low and the alarm is re-armed ready for the next trigger input.

Delayed entry switch

So much for the basic operation of the delayed entry timer. But just when you think you've got it all figured out, we now inject a complicating factor: the delayed entry switch circuit. This comprises C4, IC5d, Q3 and associated components.

Let's first assume that the switch contacts are shorted to provide for normal delayed entry. It follows that the output of IC5d will be high and thus transistor Q3 will be off. In this case, the delayed entry timer functions exactly as described above to provide a 10s entry delay.

Now suppose that we substitute a normally open reed switch as shown on the circuit diagram. Furthermore, let's initially assume that the reed switch is left open circuit. The delayed entry switch circuit now comes into play. Here's how it works.

When power is first applied, the Reset input of IC3b goes high for 10s (we'll explain why later) and quickly charges C4 to +12V via the 10kΩ resistor and D19. Thus, the output of IC5d goes low. Now when the Q output of IC3b goes high, Q3 is biased on and charges C1 via R2.

We've now got a whole new ballgame. Whereas it previously took 10s for C1 to charge via R1 (1MΩ), it now only takes about 150ms to charge via Q3 and R2 (15kΩ). So, as far as the thief is concerned, the alarm triggers instantly if a door is opened.

The 10s entry delay can be activated by momentarily closing the reed switch. This action rapidly discharges C4, forcing the output of IC5d high and turning Q3 off. C1 can now charge only via R1 and so the 10s delay is restored.

But that's not the end to the electronic skullduggery. When the output of IC5d switches high, a short positive-going pulse is applied to the Data input of IC3b via C5 and D15. This triggers the delayed entry timer which means that the alarm will sound 10s after the reed switch is closed.

So it doesn't matter whether or not a door is opened after the reed switch is closed. The alarm will still sound after a 10s delay (unless, of course, the driver enters the car and switches the alarm off).

Delayed exit timer

Schmitt trigger IC5b forms the delayed exit timer. When power is first applied, C3 pulls pin 3 high and the output (pin 4)

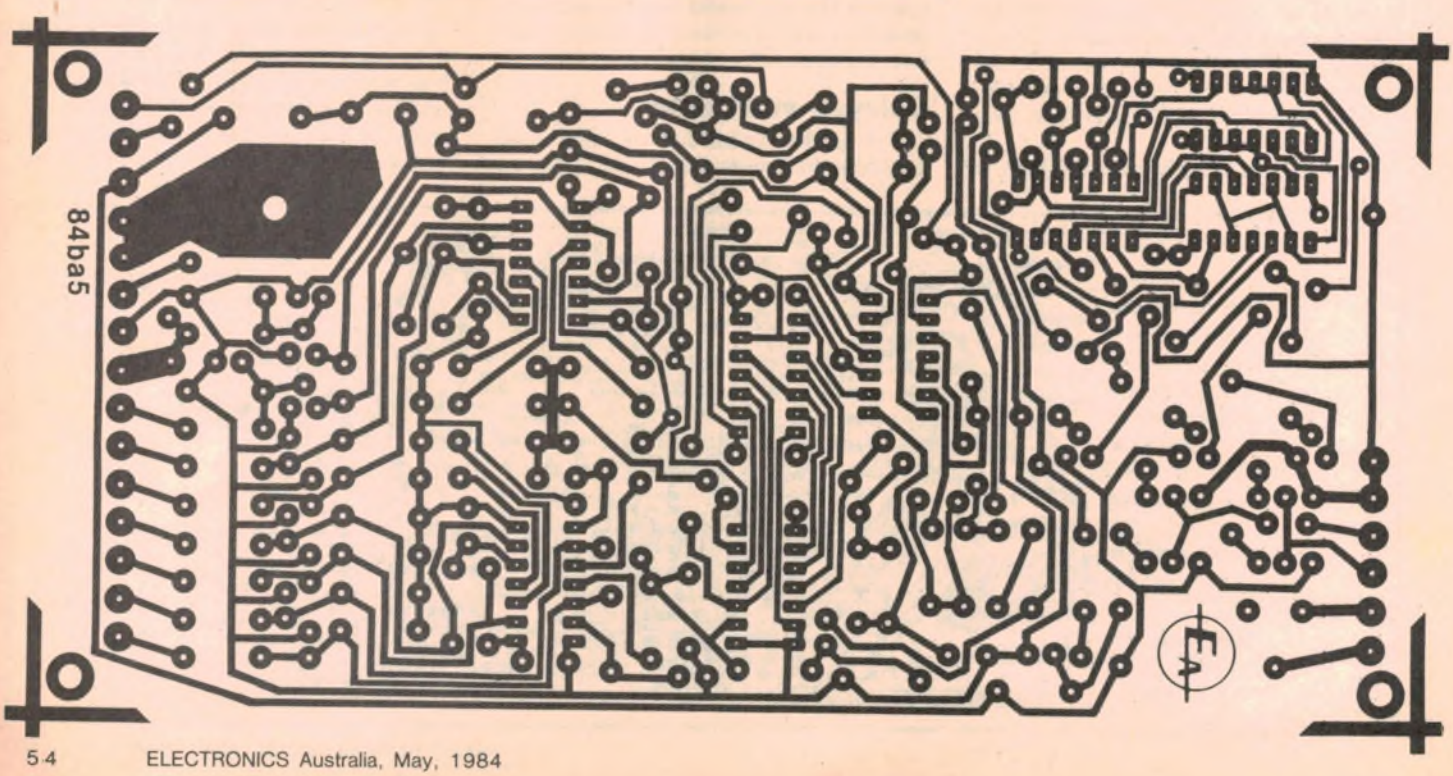
We estimate that the cost of parts for this project is approximately

$70

This includes the horn speaker but not the cost of an auxiliary battery or extra switches.

Specifications:

Inputs	Two delayed, six instant
Delay times	10 seconds delayed exit, 10 seconds delayed entry
Power supply	+12V from vehicle battery with provision for auxiliary battery backup
Alarm time	Two minutes with automatic re-arming at end of alarm time
Alarm output	1kHz tone modulated at 100Hz and 1Hz driving an 8Ω horn speaker
Current consumption	13mA standby mode, 500mA when alarm is triggered
Miscellaneous	Flashing dash panel lamp, key-operated on/off switch, provision for tow-away protection



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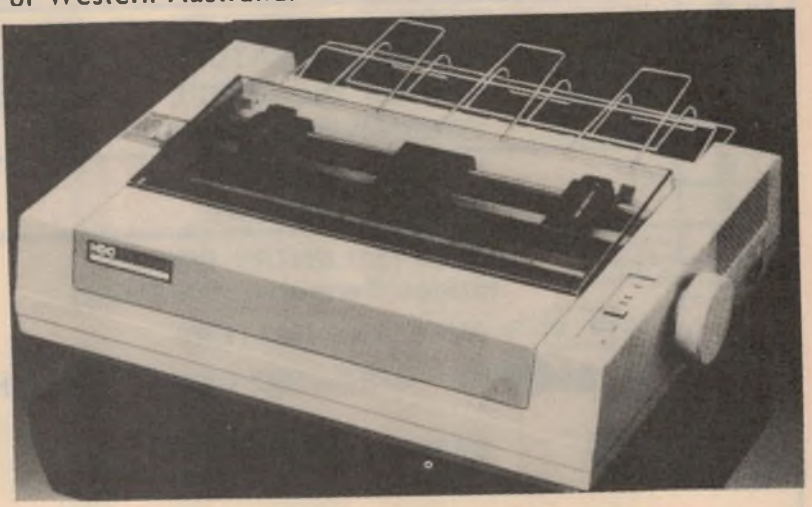

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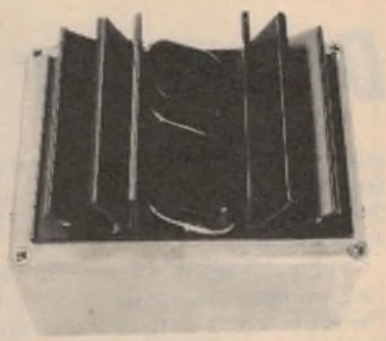

The ALTRONICS kit includes all components for the modifications, detailed by Electronics Australia February 1983.

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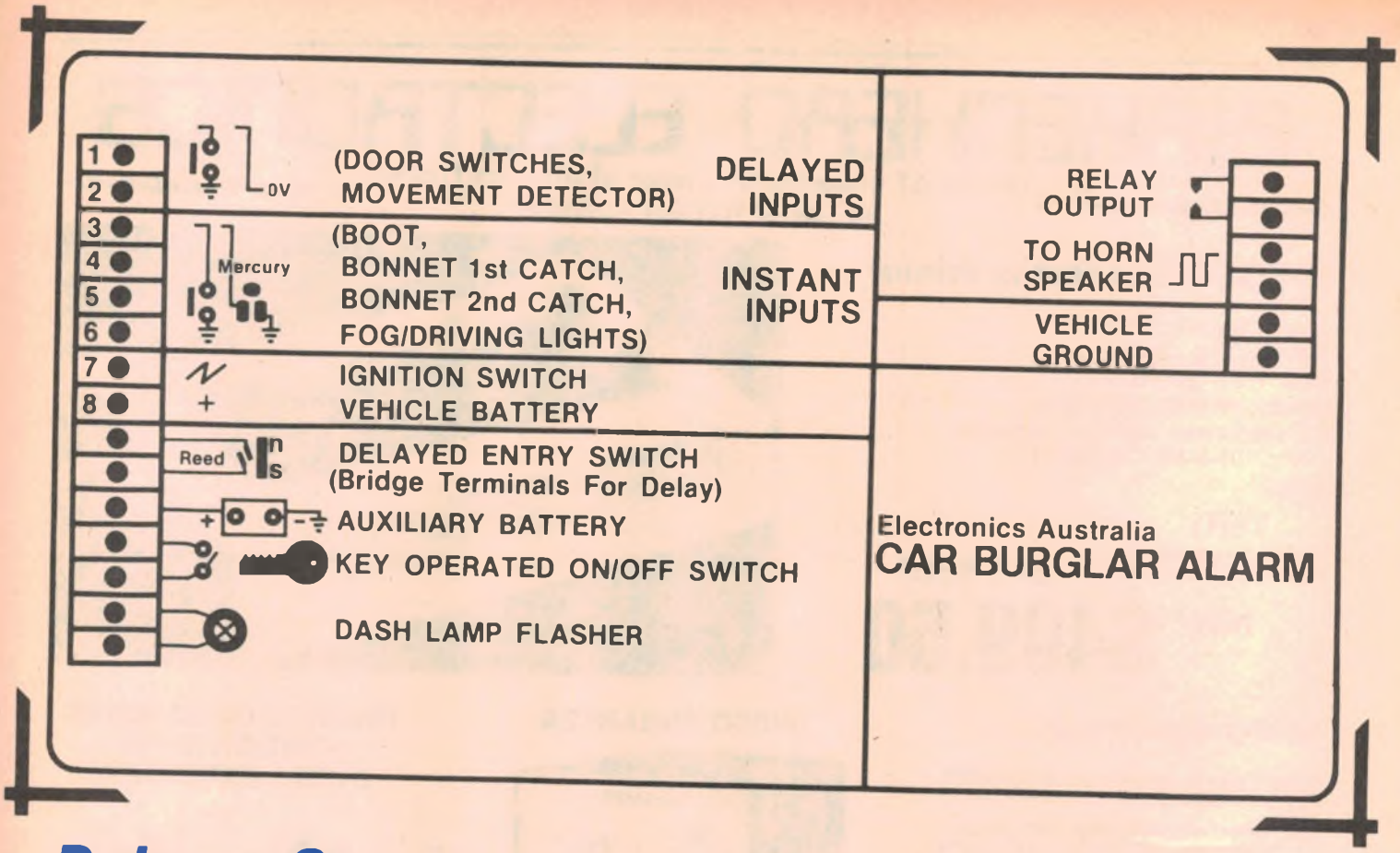

Deluxe Car Burglar Alarm

goes low. Pin 2 of IC4 and pin 13 of IC4d are thus also pulled low, which means that the Reset inputs of IC3a and IC3b are held high.

C3 now charges via R4 and, after about 10s, switches the output of IC5b low. The Reset inputs of IC3a and IC3b also now go low and the alarm is armed and ready for action.

IC5c is wired as a Schmitt trigger oscillator and drives transistor Q13 and the dash panel lamp. Notice that IC5c has two feedback paths connected between pins 5 and 6: one via the 1MΩ resistor and the other via the 100kΩ resistor and diode D22. When pin 6 is high, C6 quickly charges via both feedback paths. However, when the output is low, D22 is reverse biased and C6 can discharge only through the 1MΩ resistor.

The output of IC5c thus has a 1:10 duty cycle which means that the lamp turns on for 100ms once every second (ie, the lamp flashes at a 1Hz rate). Transistor Q14 is permanently biased on and, together with its 220Ω collector resistor, provides a 50mA standing current path through the lamp. This measure is designed to extend lamp life by ensuring that the filament is kept just above the point of incandescence.

Diodes D20 and D21 have no effect on the circuit except during the delayed entry and exit times. During the delayed exit time, for example, the output of IC5b is low and thus pin 5 of IC5c is held low by D20 which is now forward biased. The output of IC5c will therefore be high and so the dash lamp remains fully lit for the duration of the exit time.

At the end of the exit time, pin 4 of IC5b goes high, D20 is reversed biased, and the dash lamp circuit commences normal operation.

Similarly, pin 5 of IC5c is held low via D21 and the $\overline{Q}$ output of IC3b during the delayed entry time.

Horn speaker driver

As mentioned previously, the alarm sounds when the Q output of IC3a goes high. The horn driver circuit has been devised so that it draws very little current in the quiescent state.

Let's assume that the alarm has been triggered and that the Q output of IC3a has gone high. This does two things: it applies a gating signal to 3-input NAND gate IC8a and it turns on Darlington transistor Q4. Q4, in turn, drives a single pole relay with output contacts connected in parallel with the hazard flasher switch.

D23 protects the transistor against back EMF from the coil when the relay turns off.

The remaining two inputs of IC8a are connected to the outputs of Schmitt trigger oscillators IC6b and IC6c. The first oscillator operates at about 100Hz while the latter has a nominal output of 1Hz. When Q of IC3a is high, their outputs are gated through to the output of inverter IC8b and form the gating signal for the horn speaker driver circuit.

This gating signal is connected to one input of NAND gates IC7a, b, c and d. When the gating signal is low, the NAND gate outputs are high and transistors Q7, Q8, Q9 and Q10 are off. IC6e and IC6f invert the outputs of IC7a and IC7b, and so Q5, Q6, Q11 and Q12 are also off.

When the gating signal goes high, a 1kHz tone signal for the horn speaker is gated through to the transistor driver stages by the IC7 NAND gates. This 1kHz tone signal is generated by Schmitt trigger oscillator IC6a which, incidentally, also provides clock signals for IC3a and IC3b. Note that the 1kHz signal is inverted before it is applied to IC7a and IC7c.

The transistor driver stage operates in push-pull mode. When the output of IC6a goes high, the output of IC6f also goes high and turns on transistors Q12 and Q6. At the same time, the output of IC7d goes low and turns on transistors Q9 and Q7. One side of the horn speaker thus goes to the positive supply

rail while the other goes to ground.

Similarly, when the output of IC6a goes low, Q6, Q7, Q9 and Q12 all turn off and Q10, Q8, Q11 and Q5 turn on. In this manner, each side of the horn speaker is switched at a 1kHz rate from one polarity to the other.

This 1kHz tone is modulated at 100Hz by IC6b, while IC6c switches the tone on and off at a 1Hz rate (ie, on for 0.5s and off for 0.5s). The result is an ear-piercing alarm tone that's sure to attract attention.

Power supply

Power for the alarm circuit is derived from the vehicle battery and also from the optional auxiliary battery. Note that the auxiliary battery is charged via D25. This diode prevents the auxiliary battery from discharging into the vehicle battery should the latter go "flat".

Supply line decoupling is provided by a 10Ω resistor and a 1000μF capacitor, while zener diode D24 protects the circuit from voltage spikes. Short circuit protection is provided by fusing the vehicle and auxiliary battery supply lines to 10A and 3A respectively.

Construction

Construction of the Car Burglar Alarm is a heck of a lot easier than understanding how it works. All the parts are mounted on a PCB coded 84ba5 (88 x 181mm) and this is housed in a plastic zippy case measuring 190 x 60 x 110mm. A Scotchcal front panel gives the unit a professional appearance as well as providing a legend for all the external wiring connections.

Begin construction by installing the 22 wire links, then mount the diodes, resistors and capacitors. Note that the diodes and electrolytic capacitors must be mounted with due regard to polarity so check your work carefully as you proceed. The diode type numbers can be gleaned from the circuit diagram.

Diode D25 is a 10A stud-mounting type and should be screwed securely to the PCB using the nut and lockwasher supplied. The anode terminal is then connected to the PCB using 1mm-thick tinned copper wire. This lead should be insulated with spaghetti tubing.

The transistors can be mounted next and should be pushed down onto the PCB as far as they will comfortably go. As with the diodes, you will have to refer to the circuit diagram for the type numbers. Make sure that you install the transistors the right way round.

External connections to the alarm are handled by PCB-mounting terminal blocks. A 6-way section is installed adjacent to the relay while 5-way and 10-way sections are mounted at the other end of the PCB adjacent to the input diodes.

PARTS LIST

1 PCB, code 84ba5, 88 x 181mm
1 plastic zippy case, 190 x 110 x 60mm
1 12V single pole relay, 180Ω
1 8Ω horn speaker
1 Scotchcal front panel, 190 x 108mm
1 10-way PCB-mounting terminal block
2 6-way PCB-mounting terminal blocks
1 barrel-type keyswitch
1 12V bezel lamp (red)
1 reed switch and magnet set
4 12mm standoffs
1 mercury switch
1 spring-loaded automotive switch
1 12V motorcycle battery, 1.2Ah capacity or greater (optional)
1 3A fuse
1 10A fuse
2 in-line fuseholders

Semiconductors

2 4011 quad 2-input NAND gates
1 4013 dual D flipflop
1 4023 triple 3-input NAND gate
1 4030, 4070 quad 2-input XOR gate
2 74C14, 40106 hex Schmitt triggers
1 BC557 PNP transistor
2 BC547 NPN transistors
4 BC337 NPN transistors
2 BC327 PNP transistors
1 BD681 NPN Darlington transistor
2 TIP31 NPN transistors
2 TIP32 PNP transistors
1 1N4002 100V diode
1 MR110 10A 100V diode
1 16V 1W zener diode
22 1N914, 1N4148 diodes

Capacitors

1 1000μF/16VW PC electrolytic
1 220μF/16VW PC electrolytic
1 47μF/16VW PC electrolytic
11 10μF/16VW PC electrolytic
1 2.2μF/16VW PC electrolytic
9 1μF/16VW PC electrolytic
2 .01μF metallised polyester

Resistors *(¼W, 5% unless stated)*

6 x 1MΩ, 23 x 100kΩ, 1 x 15kΩ, 5 x 10kΩ, 10 x 1kΩ, 1 x 220Ω 1W, 4 x 100Ω 1W, 1 x 10Ω

Miscellaneous

Hookup wire, tinned copper wire, automotive connectors, machine screws and nuts, shakeproof washers, warning stickers, solder, etc.

Assembly of the PCB can now be completed by installing the CMOS ICs and the relay. Note that all the ICs are CMOS devices so solder the supply pins (7 and 14) first to enable the internal static protection diodes. The hazard flasher relay can be regarded as optional – if you want to save a few dollars it can be deleted from the circuit along with Q4 and D23.

Finally, the Scotchcal label can be affixed to the lid, the various holes drilled in the case, and the PCB mounted on 12mm standoffs. Use shakeproof washers under all mounting nuts, as this project will be subject to a good deal of vibration.

Testing

The test procedure is as follows:

- switch on the alarm and check that the dash panel lamp remains fully lit for 10s. Check that none of the inputs can trigger the alarm during this 10s exit time.
- check that the dash panel lamp flashes at the end of the exit time and that all inputs now instantly sound the alarm. Inputs 1-6 can be test triggered by momentarily shorting them to ground; input 7 by applying +12V to the input; and input 8 by shorting the base of Q2 to ground.
- check that the alarm sounds for about two minutes when triggered and that the relay closes.
- check that the alarm sounds after a 10s delay if the reed switch terminals are momentarily shorted.
- short the reed switch terminals permanently and check that the delayed trigger inputs sound the alarm after a 10s delay (the entry time). Check that the dash panel lamp is fully lit during the 10s delay.

Finally, make sure that you install the alarm in a professional manner. Use 10 x 0.2mm (or thicker) hookup wire for all external connections and terminate all leads in suitable connectors. In fact, it is a good idea to purchase an assortment of automotive quick connectors, bullet connectors and lugs before commencing installation.

The alarm can be mounted in any convenient location but, for most cars, the best place will be under the rear parcel shelf inside the boot. The auxiliary battery can also be mounted in the boot and should be securely clamped. Run leads to the front of the vehicle alongside existing wiring looms and don't omit the in-line supply fuses or you could get a fire in the event of a short.

The horn speaker can be mounted in the engine bay, but make sure that neither it nor the wiring to it is accessible from outside the vehicle. In fact, the effectiveness of this alarm ultimately depends on just what sort of a job you make of the installation.

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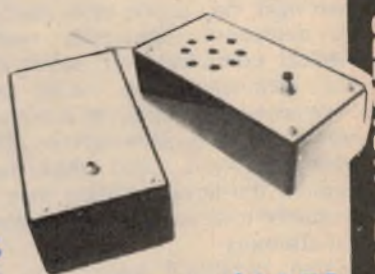

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by COLIN DAWSON

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Even when used in conjunction with other bio-measurements (the "polygraph"), lie detector tests are far from universally accepted. Although the skin resistance measurements do appear to bear some relationship to the level of stress, there is much controversy when it comes to interpreting the results. This project is designed to measure stress as a means of "bio-feedback", without any unpleasant implications regarding honesty.

Ultimately, stress measurement in its own right may prove more useful than "lie detection". Apparently, numerous medical complaints are stress related and eliminating the cause of the complaints must surely be preferable to prescribed cures. Although the ability to relax properly is a skill which must be learned, the Stress Monitor may be of assistance to those who are making their first attempts.

Some published information claims that changes in skin resistance for any given environment are a direct indication of the subject controlling his state of relaxation. We can verify that a certain amount of conscious control over skin resistance is possible. While we can not state with certainty that this in itself is relaxation, it does in all probability put the subject in a state conducive to worthwhile relaxation.

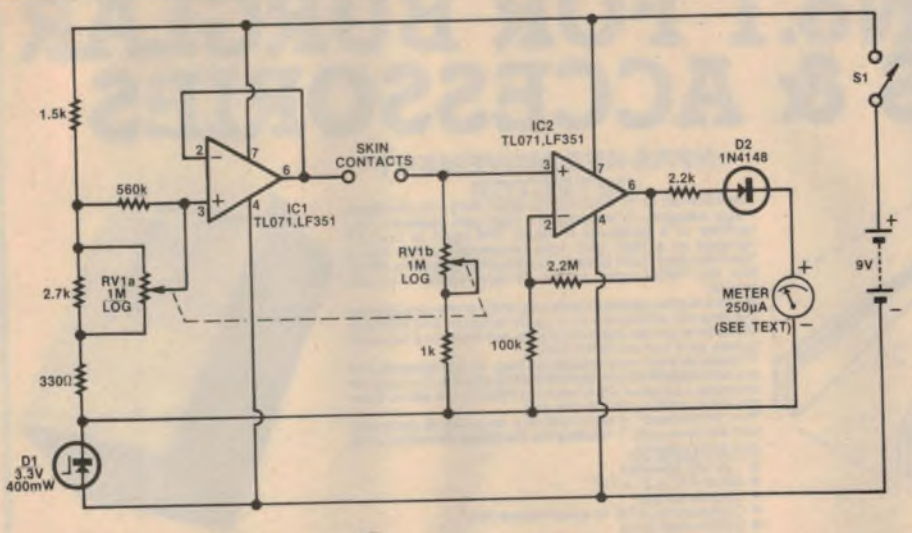
This type of self therapy can be useful in lowering the blood pressure of hypertensive patients. Some people claim that it also contributes to a general sense of well being, although this would probably require frequent and lengthy sessions.

Unfortunately, relaxation is not something which can be achieved by a determined effort. In fact, anyone who approaches stress relief with the intention of forcing himself to relax will usually achieve the opposite effect. Some form of bio-feedback is needed to assist the subject in achieving his objective, and we hope that the Stress Monitor can be useful here.

As there is not sufficient data available, we can not boldly proclaim that stress monitoring is an accepted branch of medicine – at least not by measuring skin resistance. The final assessment of a project such as this rests with each individual constructor.

An obvious question to pose at this stage is "Why can't I just use a multimeter set to its resistance range?" The anwser is that you could – under certain conditions and with limited success. Because skin resistance can be very high (over 10MΩ with poor contacts and low ambient temperature), most analog multimeters would not have sufficient resolution at high resistances. Whilst digital meters would have the resolutuion, the digital display is not suitable for this project.

The circuit described here has



STRESS MONITOR

3/EG/-

PARTS LIST

1 PCB, 70 x 28mm, code 84eg3
1 Meter, 0-250µA (see text)
1 Project box to suit (see text)
1 Scotchcal front panel label, 87 x 62mm
1 single pole, single throw (SPST) switch
1 knob to suit potentiometer
2 4mm panel sockets
2 4mm plugs
2 skin contacts (see text)
1 strip of "Velcro" fastening material
1 9V battery (Eveready 216)
1 battery clip to suit

SEMICONDUCTORS
2 FET-input op amps, LF351 or TL071
1 3.3V zener diode
1 1N4148 diode

RESISTORS (5%, ¼W)
1 x 2.2MΩ, 1 x 560kΩ, 1 x 100kΩ, 1 x 2.7kΩ, 1 x 2.2kΩ (see text), 1 x 1.5kΩ, 1 x 1kΩ, 1 x 330Ω, 1 x 1MΩ dual ganged potentiometer

useful resolution at high resistances and also has the desired analog display. It has two FET-input op amps which enable it to measure skin resistances of over 20MΩ. The sensitivity is adjustable over a wide range to compensate for different test conditions and skin contacts. Adjusting the sensitivity simultaneously adjusts the potential applied to the contacts, although this never exceeds 2V. Because of this "double" adjustment, the response of the circuit is nearly logarithmic – this contributes to the wide range of skin resistances that can be monitored (over 4000:1).

We estimate that the current cost of components for the project is approximately

$29

This includes sales tax, but not the cost of a battery.

Op amp circuit

The circuit is quite simple, its main elements being the two FET-input op amps, a dual ganged potentiometer and a 250µA meter. Consider first the operation of IC2 which is quite conventional for this type of circuit. It is a non-inverting amplifier which senses the current through the skin contacts and drives the meter. IC2 (an LF351 or TL071) has a gain of 20 which enables it to produce a full scale deflection of the meter for skin resistances up to 20MΩ.

A rather less conventional aspect of the Stress Monitor is its use of a dual ganged potentiometer (RV1a and 1b). This enables simultaneous adjustment of the voltage applied to the contacts and the amount of resistance in series with them. By this means, the sensitivity control is given a greater range of control than could be achieved with a simple linear control. In fact, the Stress Monitor can cope with skin resistances between 5kΩ and 20MΩ.

A 3.3V zener diode provides a reference for both op amps. This voltage is fed into the inverting input of IC2 through a 100kΩ resistor. The non-inverting input of IC2 is connected to a divider consisting of the skin contacts, a 1kΩ resistor and RV1b. This divider is connected across the output of IC1 and the 3.3V reference, with the connection to IC2 being made at the junction of RV1b and the skin contacts.

A second, and more complicated divider is used to control the voltage which appears at the output of IC1. RV1a forms part of this divider and swings the voltage at its wiper between 0.3 and 2.5V above the reference. In fact, this is the voltage which must be applied to the skin contacts but it must be buffered (by IC1) first.

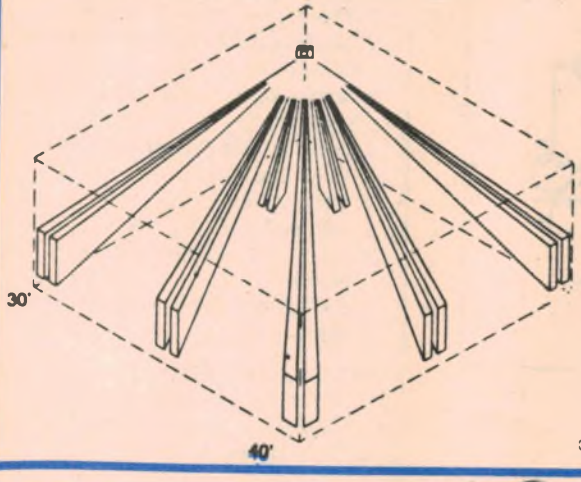
If we were to connect the wiper of RV1a directly to the skin contacts a loading problem would arise when the resistance of the skin is less than the 1MΩ of RV1a. This would alter the test voltage and lead to false indication of relaxation. Of course, the problem could be avoided by using a lower value of resistance for RV1 but that would prohibit the use of a readily available dual gang potentiometer as RV1b must be 1MΩ.

Notice that the output of IC2 is not connected directly to the meter. Rather, it is connected through a series resistor and diode. The diode cancels the effect of any offset voltage which may appear at the output of IC2, thereby ensuring that the meter will read zero when the contacts are open circuit. Because we have used a 250µA meter, a 2.2kΩ current limiting resistor was necessary. This permits the meter to be adjusted to full scale with a skin resistance of 20MΩ, thereby affording maximum protection to the movement. Other meters may dictate that the value of the limiting resistor be changed.

Construction

Assembly of the printed circuit board components is very straightforward and should present no problems. The

JAYCAR No.1 FOR BURGLAR ALARMS & ACCESSORIES



INFRA-RED MOVEMENT DETECTOR

The infra-red or IR detector for short, falls into the Black magic category. It basically is a high gain passive tuned receiver of a particular IR band. The heart of the unit consists of a high gain lens (antenna?) which has a "Commutated" field of view. Its reception pattern is comb-like, but highly tuned to the IR wavelength of human bodies.

When a human passes within proximity of the pickup area, the lens will selectively pick up IR radiation and then not. Movement across the pickup area will result in a series of pulses sent to a detector circuit.

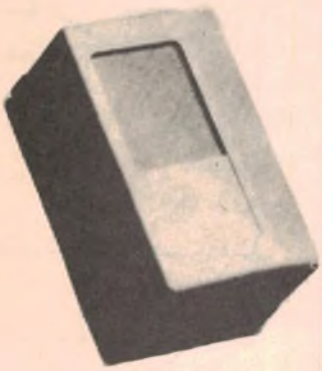
IR detectors are very reliable as they do not transmit and will not respond to non heat radiating objects. Curtains, for example, can wave about without tripping the alarm. Even the cat is unlikely to trip the unit.

The "Arrowhead" is the latest of a series of IR detectors that we have sold. It represents the latest developments.

FEATURES:

- 12V DC powered
- Small 4½" x 2" x 1½"
- Double sensor
- Computerised QC to lower failure rate
- Built in test lamp
- Tamper switch included
- Alarm output SPST 30V DC @ 1A

Cat. LA-5017



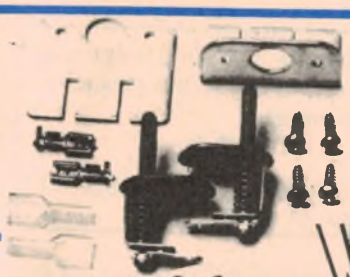
$129.50

DOOR/BOOT/BONNET SWITCH SET

European made set consisting of two spring-mounted switches with plastic actuators, two neoprene seals, two sturdy brackets, QC female connectors, boots, self-tapping screws and instructions. Switches are normally open (i.e. when boot/bonnet/door is closed). They close circuit when any of the above is opened.

Cat. LE-8776

$3.95



KEYSWITCH - SPECIAL AUTOMOTIVE TYPE

This unit features rugged neoprene rubber boot that clips over the weather-exposed part of the switch. Two special tube-type keys are included. A relatively small ½" (12mm) hole needs to be drilled in the metalwork

Cat. SM-1032

$4.95

REED SWITCH/MAGNET ASSEMBLIES -

Powerful magnets. Self-adhesive or screw mount. Two types available:

NORMALLY CLOSED (when in proximity of magnet) Cat. LA-5070

NORMALLY OPEN (when in proximity of magnet) Cat. LA-5071

Both $2.95 each (1-9)
$2.50 each (10 plus)

ALARM STICKER

Durable self-adhesive sticker that clearly tells would-be thieves there is an alarm fitted. Sticker does not refer to a specific alarm which creates further doubt.

Cat. LA-5100

95¢ each 1-9 85¢ each 10

4 SECTOR ALARM MODULE

Ledlux is an alarm module suitable for both household and commercial use.

FEATURES:

- Adjustable entry delay time
- Fixed double exit time on 2 delay sectors - 70 seconds On 2 instant sectors 7 seconds
- Inbuilt silent seal test on sectors shown by 2 Red LEDs
- Inbuilt power on signal and battery voltage monitor shown by green LED
- Inbuilt siren driver. Can drive 3 horn speakers and 1 bell
- Adjustable sound speed from - a slow wail to fast warble
- Adjustable sound time (when alarm is triggered) from 1-20 mins (pre-set at 10 mins)
- Size 110 x 85 x 20mm fully insulated
- Operation voltage 6-16V nominally 12V
- Operation current 600mA so can be used with dry batteries

Cat. LA-5160

$75.00

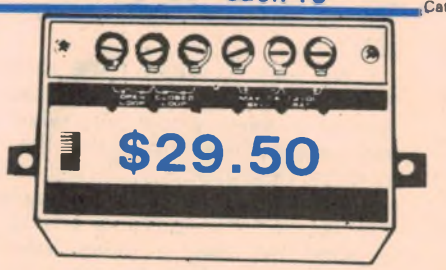
SEE OUR DOUBLE PAGE KIT AD FOR MORE BURGLAR ALARMS

LOW COST KEYLESS AUTO ALARM - A NEW PRODUCT FROM JAYCAR

AMAZING VALUE FOR MONEY - ★ Automatic - No keys - No switches ★ Siren Horn INCLUDED in price ★ Output to drive car horn relay ★ N.C. circuit loop ★ N.O. circuit loop ★ 23 seconds (approx) exit delay ★ 10 seconds (approx) entry delay ★ Auto reset ★ Comprehensive instruction/installation manual

Cat. LA - 5315

ONLY $49.95



$29.50

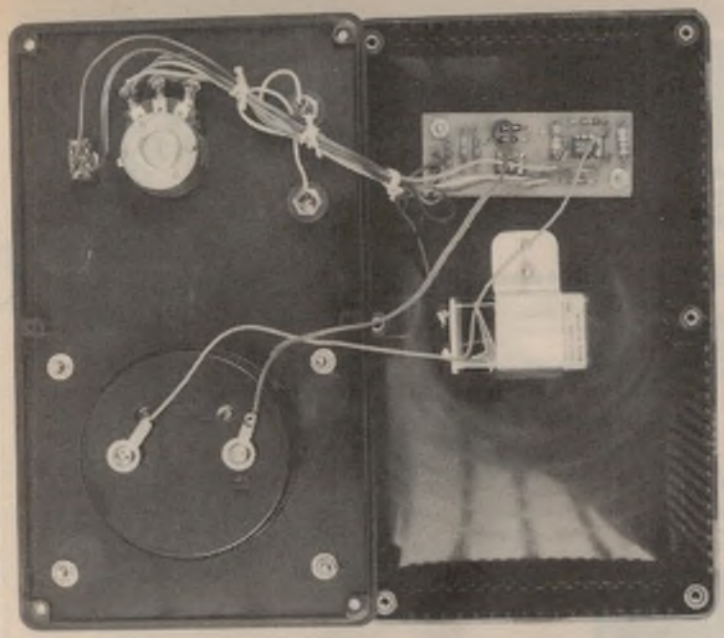
ALARM CONTROL MODULE

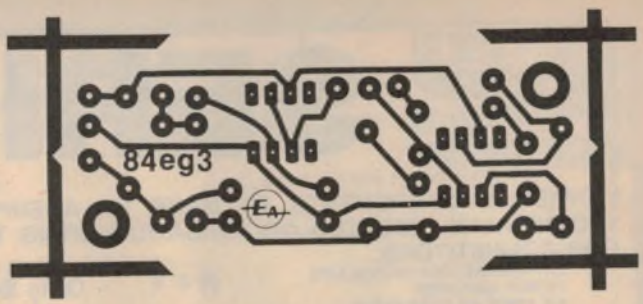
Ideal for the home, business and factory/warehouse. Control module allows soundless entry and exit. Automatic alarm re-set, 12V DC operation, both normally open for heat, smoke, vibration and normally closed for, doors, windows etc

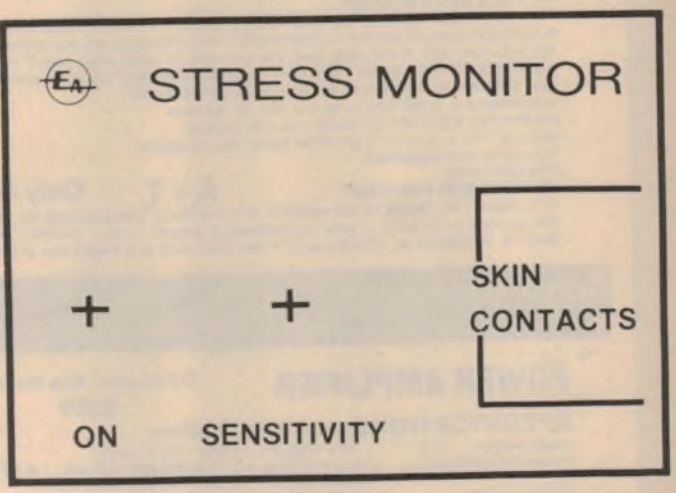
- Exit delay approximately 20 seconds
- 10 second closed circuit delayed alarm
- Instant alarm for open circuit
- Auto re-set
- Power 12V DC
- Current drain 2mA system armed

Cat. LA-5030

STOP PRESS!! **NOW OPEN ALL DAY SATURDAY (CONCORD STORE ONLY)**







Stress Monitor

polarised components are the two ICs and the two diodes – the rest are only resistors and can be mounted either way 'round.

A battery holder of some sort should be provided. We made one from a piece of scrap aluminium measuring about 65 x 20mm.

By far the most difficult aspect of construction is mounting the meter. This is particularly so for meters which are not symmetrical (the coil housing is offset with respect to the mounting screws). Regrettably, there are a number which fall into this category. Our only advice is take care and double check your marking-out.

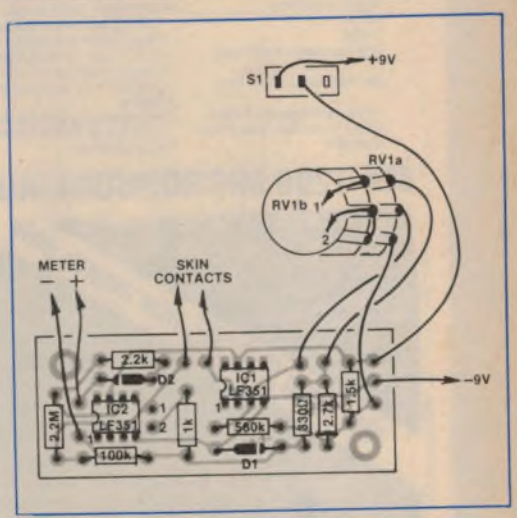
Our skin contacts consisted of two rivets pressed through two strips of Velcro. The Velcro strips are arranged so that they form a bracelet which can be fastened around the wrist or a finger. The strips overlap for about 15mm and this is where the rivets are pushed through. The heads of the rivets will be pressed against the skin when the bracelet is fastened.

We have used a large (100mm) meter and a plastic project box measuring 190 x 110 x 60mm for the project. Both of these items are quite arbitrary and could be replaced with a less expensive alternative. In fact, the meter could be omitted entirely and replaced with a multimeter set to a low current range (about 250μA). It may even be possible to build the whole project into an old multimeter, substituting the dual ganged potentiometer for the rotary control.

Aluminium rivets are best avoided for this project – they will prove rather difficult to solder to the connecting leads. Also, the inevitable thin oxide coating will reduce their effectiveness as "contacts". Plated rivets – either brass or steel – would be more suitable.

Follow the wiring diagram closely. The battery, both potentiometer gangs and the meter must be connected correctly. To test the Stress Monitor, first switch it on without touching the skin contacts. The meter should read "0", irrespective of the "Sensitivity" control adjustment. For the next test, a fixed resistance must be connected between the skin contacts – this could be your skin but a resistor of say 1MΩ might be more convenient. Rotation of the sensitivity control should take the meter through its full range of deflections. If this can not be repeated when the skin contact bracelet is used, the rivets are probably not making good contact.

To be successful, relaxation must be practised in a quiet room free from distractions – take the phone off the hook and certainly turn the TV set off. The object is to clear the mind completely of stress inducing thoughts. Slow and deep breathing (sometimes called "abdomenal breathing" because it originates from the abdomen) is essential. Some people find that it helps to concentrate all of their attention on each part of the body in turn. This starts with the toes, which must be considered individually – at least, that's what the literature says. Next, attention is moved to the feet and then in turn to the lower legs, upper legs, abdomen, chest, neck and finally the face and head. This



process can sometimes produce a tingling sensation when it is particularly effective.

A significant reduction in the level of stress is not something which can be achieved instantly. Particularly for the first few attempts, a subject must be prepared to spend at least 10 minutes per session.

When this relaxation process has been completed, the subject should be largely unaware of his environment, his attention focussed entirely on himself. When he feels that the session has been satisfactory, it is important that the subject does not suddenly end it by standing up or beginning a conversation. Instead, he must slowly become aware of his environment and restore his breathing to its normal pattern.

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POWER AMPLIFIER **A + T** **Only $449**

KIT PRICE $319 P&P $12.00

• 1% Metal Film Resistors are used where possible • Prewound Coils are supplied • Aluminium case as per the original article • All components are top quality • Over 400 Kits now sold • We have built this unit and so know what needs to go into every kit • SUPER FINISH Front panel supplied with every kit at no extra cost to you. • We are so confident of this kit that we can now offer it assembled and tested so that people who do not have the time can appreciate the sound that this amplifier puts out. This is done on a per order basis delivery approx. four weeks after placement.

PREAMPLIFIER

KIT PRICE $289 P&P $12.00 **A + T** **Only $449**

• 1% Metal Film Resistors are supplied • 14 metres of Low Capacitance Shielded are supplied (a bit extra in case of mistakes) • English "Lorlin" Switches are supplied no substitutes as others supply • We have built and tested this unit and so know what needs to go into every kit • Specially imported black anodised aluminium knobs • Again as with the power amp we are offering this kit A & T at a price which we do not believe there is a commercial unit available that sounds as good. Same delivery as the power amp.

PREAMPLIFIER Kit Price $289, P&P $12.00

SPECIFICATIONS

Frequency response:	High-level input: 15Hz-130 kHz, +0, −1 db Low-level input — conforms to RIAA equalisation, ±0.2 dB
Distortion:	1kHz <0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation).
S/N noise:	High-level input, master full, with respect to 300 mV input signal at full output (1.2V): >92 dB flat >100 dB A-weighted. MM input, master full, with respect to full output (1.2V) at 5 mV input, 50 ohm source resistance connected: >86 dB flat >92 dB A-weighted. MC input, master full, with respect to full output (1.2V) and 200 μV input signal: >71 dB flat >75 dB A-weighted.

On Special at $259
Normally $289

**All parts available separately for both kits.*

POWER AMPLIFIER

On special this month $289

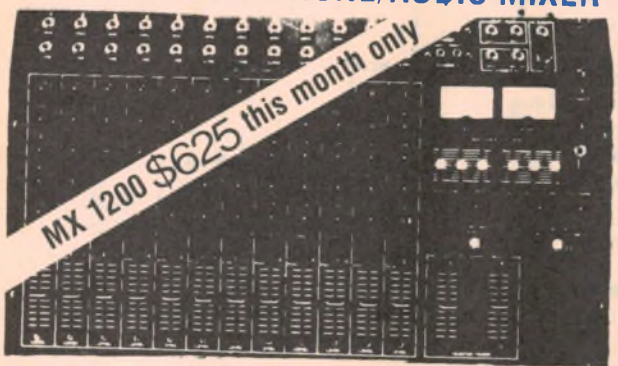
SPECIFICATIONS 150W RMS into 40hms

Power output:	100W RMS into 8 ohms (±55 V supply).
Frequency response:	8 Hz to 20 kHz, +0 −0.4 dB 2.8-Hz to 65 kHz, +0 −3 dB. NOTE: These figures are determined solely by passive filters
Input sensitivity:	1V RMS for 100W output.
Hum:	−100dB below full output (flat).
Noise:	−116 dB below full output (flat, 20 kHz bandwidth).
2nd harmonic distortion:	<0.001% at 1 kHz (0.0007% on prototypes) at 100 W output using a ±56 V supply rated at 4 A continuous. <0.003% at 10 kHz and 100 W.
3rd harmonic distortion:	<0.0003% for all frequencies less than 10 kHz and all powers below clipping.
Total harmonic distortion:	Determined by 2nd harmonic distortion (see above).
Intermodulation distortion:	<0.003% at 100 W. (50 Hz and 7 kHz mixed 4:1).
Stability:	Unconditional

Please note that the "Superb Quality" Heatsink for the power amp was designed and developed by Rod Irving Electronics and is being supplied to other kit suppliers. This product cost $1,200 to develop so that your amplifier kit would have a professional finish as well as sound.

ON SPECIAL THIS MONTH $289

MX-1200 MICROPHONE/AUDIO MIXER



This unit features: 12 microphone line inputs with pan, bass, treble, effect and fold back controls for each channel • LED peak indicators for each channel • 2 turntable inputs with cross fade and individual output controls • master equaliser for bass, midrange and treble • variable headphone output etc. etc. • complete with carrying case.

SPECIFICATIONS

INPUTS
Level/impedance Mic 46 db/1K
Line 22 db/18K x 12
Phono 52 db/50K STEREO x 2 (2mv) at 1kHz
Effect Return (Aux) 20 db/50K x 1

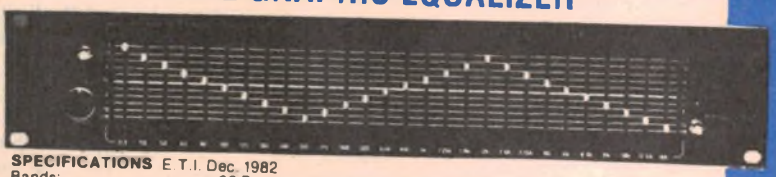
OUTPUTS
Level/impedance L & R 0 db 2K
Effect Send 0 db/2K F/B Out 0 db/2K
Head phone Stereo +10 db/600 (100 1K)

EQUALISATION
Channel
Bass ±15db
Treble ±1500
Master
Bass ±12db
Treble ±10db
Middle ±12db

FADER & CONTROLLERS
12 channel fader, Slide, 60mm, LOG 25%
2 Master fader, Slide, 60mm, LOG 15%
12 F/B Volume 300 LIN
1 F/B Master level 300 LIN
12 Effect Send 300 LIN
1 Effect Return 300 LOG 15%
2 Phono 300 LOG 15%
1 Head Phone 300 LOG 15%
S/N 58DB
FREQUENCY RESPONSE 20-20 KHz
TOTAL HARMONIC DISTORTION Less than 0.1%
METER 2 illuminated VU Meters 0db = 0.775V
PEAK INDICATOR 12 LED Peak indicators
VOLTAGE 240 VAL 50Hz
POWER CONSUMPTION 7.2 watts
DIMENSIONS 620 (W) x 386 (D) x 108 (H) mm (supplied complete with carrying case)

NORMALLY $799

THIRD OCTAVE GRAPHIC EQUALIZER



SPECIFICATIONS E.T.I. Dec. 1982

Bands:	28 Bands from 31.5 Hz to 16 kHz
Noise: 20 kHz bandwidth	<0.008 mV, sliders at 0, gain at 0 (−102 dB).
Distortion	0.007% at 300 mV signal, sliders at 0, gain at 0; max. 0.01%, sliders at minimum.
Frequency Response:	12 Hz-105 kHz, +0, −1 dB, all controls flat
Boost & Cut	14 dB

1 unit $189

2 units $359

SERIES 4000 SPEAKERS.

- 8 speakers with crossovers $499
- Speaker boxes (assembled with grill and speaker cutout) ... $299
- Crossover kits $199
- Complete kit of parts (speakers, crossovers, screws, innerband, boxes) $799
- Assembled, tested, ready to be hooked up to your system ... $849

WE BELIEVE THAT WE ARE NOW THE ONLY ONES TO SUPPLY COMPLETE SPEAKER KITS ASSEMBLED AND TESTED FOR THOSE WHO HAVEN'T GOT TIME $849 EX STOCK.

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VIDEO SWITCHING BOX

Built and tested

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Low loss R.F. switching—allows inputs for:- VCR, video disc, antenna, cable TV, home computer and video games

WE HAVE A GREAT RANGE OF VIDEO CONNECTORS AND CABLES FOR VIDEO TO VIDEO DUBBING.

Cables

PA-25
5 pin 180 degree dubbing adaptor—Reverse pins for video use **$6.95**

VC-14
8 pin square plug to 8 pin square plug. Cable length 2 metres **$29.95**

VC-15
6 pin DIN plug to 6 pin DIN plug. Cable leng . .5m **$4.95**

VC-1
BNC plug to BNC plug. Impedance-75Ohm. Cable length 1.5m **$6.50**

VC-2
BNC plug to PL259 plug. Impedance-75Ohm. Cable length 1.5m **$6.75**

VC-3
PL 259 plug to PL 259 plug. Impedance-75Ohm. Cable length 1.5 **$4.95**

VC-4
PL 259 plug to RCA plug. Impedance-75Ohm. Cable length 1.5m **$4.95**

VC-5
RCA plug to RCA plug. Impedance-75Ohm. Cable length 1.5m **$5.95**

VC-6
BNC plug to RCA plug. Impedance-75Ohm. Cable length 1.5m **$5.95**

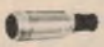
Video Connectors

VP-8
8 pin square video connector plug **$7.50**

VS-8
8 pin square video connector inline socket **$7.50**

VP-10
10 pin male video plug. Used in J.V.C., Panasonic, Sharp and other VHS machines **$11.50**

VS-10
10 pin female inline socket. Used in J.V.C., Panasonic, Sharp and other VHS machines **$11.50**



VP-14
14 pin male video plug. Used in Sony, Sanyo, Toshiba and other Beta machines **$16.50**

VS-14
14 pin female inline socket. Used in Sony, Sanyo, Toshiba and other Beta machines. **$16.50**

VIDEO HEAD CLEANERS

HC-1 V.H.S. Video head cleaner
HC-2 Beta Video head cleaner

A professional head cleaner—employs new "double sided" cleaning action—no need to "operate" on your machine. Just insert the cassette, play for 30 seconds and the job's done. Effective for 100 operations.

HC-1 $17.50 HC-2 $17.50

ELECTRONIC CASSETTE DEMAGNETISER

Cassette heads should be demagnetised every 30 hours for optimum performance. Technically the best available and easy to use, completely automatic — with LED indicator

Battery: LR-44, SR-44
Battery life: 600 applications
Flux density: 220 gauss/650Hz
Circuit: 4 transistor — 4 diode

$16.95

Twin probe for more effective magnetic field 240V AC operation — on/off switch — indicator light insulated tip

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Video library storage case — looks just like hard cover book — with identification card pouch

		1-9	10+
A15035	BETA	$2.75	$2.25
A15036	VHS	$2.95	$2.35

VIDEO ENHANCER

Built and tested

Bargain Price $75.00

Detail Enhancer VP5030 is another important contribution to the world of video accessories. The lightweight Detail Enhancer has been particularly designed to rectify loss in detail derived from VCR tapes and picture impairments. With simple adjustments for more or moderate detailing, the detail enhancer can also overcome such picture impairments as loss of detail and disappearance of verticle lines.

Specifications:
1. Power requirement: 12V DC 110mA
2. Input: 1 Video (RCA connector)
3. Outputs: 3 Videos (RCA connectors)
4. Output lever: Video outputs: 1.0Vp-p, 75 Ohm unbalanced below 1Vp-p out
5. Enhance: Enhance 9dB (Reference 1.0Vp-p)
6. Signal-to-noise ratio: Greater than 50dB below 1Vp-p out

VIDEO STABILIZER

VP-5010

Image stabilizer — ensures no vertical roll or blackout occurs. With slight adjustment immediately stabilises picture of pre-recorded tapes — removing the copyguard signal, which tends to upset video recorders

Power Requirement	9VDC negative earth*
Input	2 video (RCA connectors)
Output	1 video (RCA connector)
Oscillator Freq	3590Hz
Output Level	Video out 1.0V P.P. 75 ohm unbalanced
Gain	1 (0dB)

*PP300 recommended power source

$79.50

DM726L LOW IMPEDANCE — OMNI DIRECTIONAL $11.95
DM726H HIGH IMPEDANCE — OMNI DIRECTIONAL $12.50

Impedance:	L = 500 ohm H = 20K ohms
Freq. response:	40-14KHz
Cord/Plug:	1.5 metres/6.5mm plug
Dimensions: With on/off switch	500 × 272mm

WIRELESS MICROPHONE

Tunable	88-108MHz
Freq. Response	100-10KHz
Battery	1.5V UM3/AA
Type	Electret condenser

$11.95

THIS MONTH ONLY

DM-18 STOP/START CASSETTE MICROPHONE

Impedance: 200 ohm
Freq. Response: 250-10KHz
Sensitivity: −74dB
2.5 and 3.5mm plugs

$5.95

TDK AUDIO TAPES

	1-9	10+
D 46	2.64	1.93
D 60	2.86	2.09
D 90	3.08	2.31
D 120	5.23	3.85
AD 60	3.47	2.86
AD 90	4.29	3.30
AD 120	6.49	5.39
ADX 60	4.46	3.30
ADX 90	5.28	4.18
SA 60	4.68	3.74
SA 90	5.28	4.29
SAX 60	5.78	5.06
SAX 90	6.38	5.72
MAC 60	10.45	9.35
MAC 90	11.28	8.75
MAR 60	13.42	10.95
MAR 90	17.29	15.35

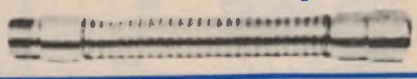
TDK VIDEO TAPES

60	12.50	11.00
120	14.00	13.00
180	15.00	14.50
240	25.00	23.50

GN15

Goose neck 5/8" male to 5/8" female 15cm long

$4.95



GN33

Gooseneck 5/8" male to 5/8" female 33cm long

$6.95

Errors and omissions excepted.

The Serviceman

TV/VCR compatibility problems

One aspect of TV servicing which I have not dealt with so far in these notes is that of video recorders. While servicing of the actual machines is something we will have to face up to in the future, the current scene, in the main, is one of making a new recorder work with an existing TV set; something which can be quite tricky at times.

My own experience in this field has been quite limited, being confined mainly to sorting out incompatible antenna plugs and sockets and helping customers to follow the not always very well written Japanese/English instruction manuals. In one case, at least, the instructions turned out to be quite definitely wrong.

But, while my experience has been limited, my colleague on the NSW south coast has been much more fortunate – if that is the right word. Perhaps because people in outlying districts normally have a choice of only two programs, compared with four or five in the capital cities, or perhaps because there are fewer alternatives, such as the cinema and live entertainment, it seems that people in his area are more attracted to the recorder than those in my suburban environment.

So what follows is from my colleague's notebook, told more or less in his own words.

The main problem involving any video recorder installation concerns the TV set's ability to handle the signals coming from the recorder, and particularly the sync pulses. More precisely, there is a tendency for some sets to suffer from picture bend or pulling, sometimes only at the top of the picture, at other times more randomly.

The basis of this problem is the simple fact that few recorders present the TV set with a set of sync pulses which are as precise as those received from a TV station. Minute variations in tape or drum speed, in spite of the best efforts of the servo mechanisms, mean that the sync pulses suffer from short term variations not encounted with off-air signals and not envisaged when many early TV sets were designed.

Because of the precise nature of the off-air signals, set designers in the pre-recorder era tended to give the horizontal flywheel circuits fairly long time constants, on the basis that it wouldn't do any harm and might be marginally beneficial under weak signal conditions where sync pulses might be momentarily lost in noise.

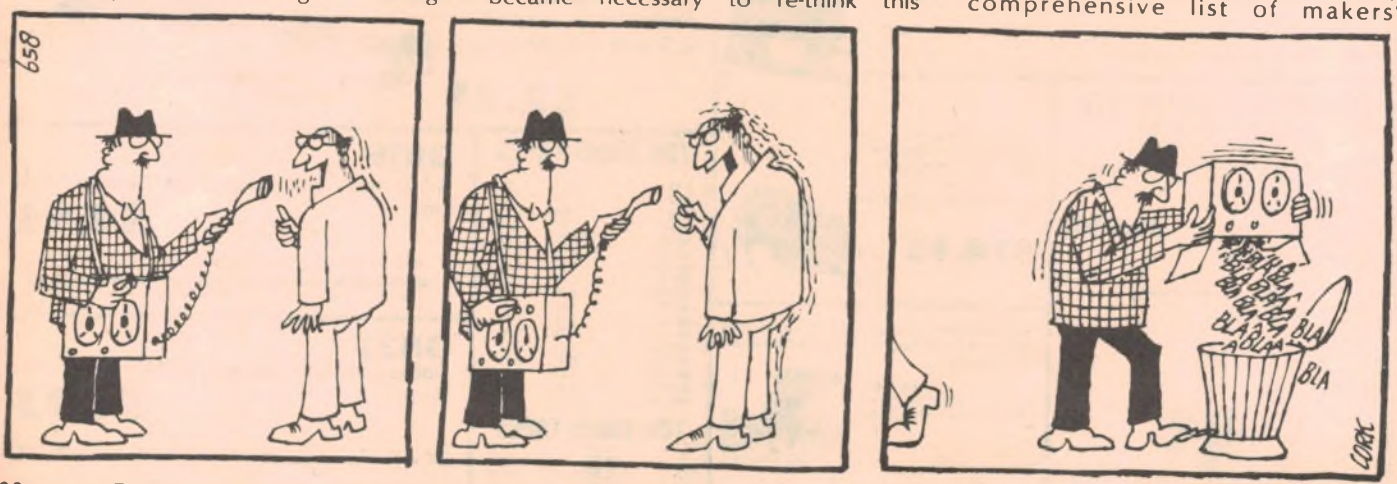
With the advent of the recorder it became necessary to re-think this philosophy. The less precise signals from the recorder make it essential that the TV set be able to adjust itself much more rapidly to these variations; in short a better compromise flywheel time constant was needed, one which is short enough to follow the likely recorder variations, yet still long enough to minimise noise interference.

In practice, it turned out that many early sets – but by no means all – did suffer from this problem, but that in most cases it was relatively easy to modify the time constant and thus solve the problem. Later TV set designs took this problem into account and provided for the shorter time constants. For the most part these sets do not present any problems but, again, there are exceptions.

What to do

Realising the problem, most manufacturers have indicated whether or not their sets are likely to need modification and, if so, what form it should take. These recommendations are usually quite accurate but it would be wrong to expect them to be infallible. Some recorder/TV set combinations can be particularly cranky, and the serviceman will have to make his own variations on the maker's recommendations.

To date I have compiled a fairly comprehensive list of makers'



recommendations, involving both those sets which do not normally need modification and those sets which do, and what form they should take. Here it is, and I suggest that you transfer it to the appropriate service manuals if you do not already have the information. Sooner or later it's bound to come in handy.

First, the good news. Those sets which are unlikely to need modification include the AWA-Mitsubishi models, the Decca 33 series, General, Hitachi and Pye in the 34 to 48cm range (some 53 and 63cm models need modification, details to come). Also included in this category are all Rank, Sony, Sanyo (except the 5603) and Toshiba models.

Now the bad news

The following sets are likely to need the modifications as shown. I have listed these in brief detail form only and it will be necessary for the reader to refer to the appropriate circuit diagram to identify the component and other changes.

HMV: the Australian made HMV and Healing models C211 and 212. On IC TBA920S, on the line board, pin 10 should be connected to ground. On model C221, a later version, both pins 9 and 10 should be connected to ground. Also, in some cases, connect a 1kΩ resistor and a 2.2μF capacitor, in series, from pin 11 to ground and, from pin 3, connect an 82pF capacitor to ground.

Comment: I have found some sets with some or all of these mods already fitted in production but, in general, they do not appear to be particularly effective. In short, these can be tricky.

Kriesler: Models 59-1 to 59-6 need modification. For models 59-1, 2 and 3, the line control module C8701 should have pins 3 and 10 connected together and pin 11 connected to ground (this modification works virtually 100%). For model 59-4, connect pin 8 of module CU451 to ground. For model 59-5, connect pin 8 of CU451 to pin 1 of this module. Modifications for the model 59-6 are the same as those listed for the Philips K12 and the Pye T37.

National: All the CP2000 series, and all the TC series, except TC2005, 2550, 2232, and 2252 need modification. For the M4 series chassis change C508 from 10μF to 3.3μF. On the S1 series chassis change C508 from 10μF to 3.3μF and fit a 390pF capacitor across R502. Re-adjust horizontal hold if necessary. On the M7 and M8 series chassis move jumper lead to the opposite end of R506. This lead comes from pin 5 of IC501.

Philips: Models K9, K9A, and K11 all use the line control module U330 and require the same modification. Bridge pins 11 and 8, and pins 10 and 3 of this module (this modification works well). The KT2A series chassis use line control module U177. Join pins 11 and 14, and pins 10 and 3.

The KT3 series use line control module U475. Some of these sets will have been modified in production. If not, link pin 19 of U475 to the junction of R381 (27Ω), C386 (47μF), and R393 (3.3kΩ).

Philips K12, Kriesler 59-6, and Pye T37: These use line control unit U455 and require that a 12kΩ resistor be added from pin 1 to pin 17, with a 10kΩ resistor from pin 17 to pin 11, and 5.5V applied to pin 17.

Pye: Models T29, T30, T30C. In practice I have found that these seldom need modifying but, if necessary, do the following. Change C605 from 6.8μF to 1μF tantalum, change C608 from .015μF to .001μF, and change R612 from 22kΩ to 12kΩ, 1W. The makers recommend that, in stubborn cases, C819 be changed to 820pF, and R893 from 3.3MΩ to 1.5MΩ 1W. (The first three components are on the line board, the last two on the small signal chroma board.)

Pye T34 series: Change C608 from 6.8μF to 1μF tantalum, change C607 from .015μF to .001μF, and change R618 from 18kΩ to 12kΩ 1W. Disconnect R502 from the cathode of D51 and connect to the 12V rail. (The 12V rail is connected to the anode of D51 via R502.) If necessary, change C891 from 470pF to 820pF and R893 from 3.3MΩ to 1.5MΩ. (The first four components are on the line board and the last two on the chroma board.)

Pye T36 series: Most of these use the U177 module as in the Philips KT2A. If so, link pins 11 and 8, and link pins 10 and 3. Pye T37: the same as Philips K12. Pye T38: the same as Philips KT3A.

Sanyo: CTP5603 and similar 75 series chassis. Change C403 from 10nF to 470nF. Change resistors across AFC diodes: R463 from 15kΩ to 68kΩ, R464 from 22kΩ to 100kΩ.

Well, that covers what might be termed the routine procedures for most of the popular sets and, in most cases, may be all that is necessary. But other problems can arise, particularly in the case of recorders which deliver their signal on UHF only. A few short stories will illustrate what I mean.

Wrong biscuit

The first story concerns an AWA Mitsubishi receiver, one of the K series. This is fitted with a UHF tuner and, on the strength of this the owner had purchased a recorder with a UHF output. However, when the dealer delivered the recorder to the customer's home, and tried to make it work, it wouldn't. This was where I was called in.

The problem was simple enough really. This set uses a standard 13 channel turret tuner but is, or should be, supplied with an extra tuner biscuit

designed to take the output from the UHF tuner, which is in the VHF band. This can be fitted in the position of any unused channel in the turret, but the makers recommend channel 5 and, in fact, mark this position on the selector as "5U", implying that it can be used for either function.

In this case the set had been supplied with a channel 5 biscuit fitted to the turret, but no spare UHF biscuit. The dealer, on the other hand, imagined that the set would normally be fitted with the UHF biscuit in this position, with the channel 5 biscuit as a spare.

The situation was explained to the customer and I suggested that I could fit a UHF biscuit, knowing that I had some spares in stock. The only complication is that the set is so compact that getting at the tuner is a major undertaking, and not one I was keen to tackle in his lounge room. I quoted him a price, he agreed to have the job done, and I loaded the set and the recorder into the waggon.

Back at the shop the job was duly completed, and I connected everything up and tried to get a signal out of the recorder. It worked, but only just, and the picture was very noisy. It ultimately transpired that the UHF tuner was on the blink – specifically, the RF transistor had packed up.

It was a most unfortunate situation, but one which could not have been foreseen. I had to advise the customer that he now faced the additional expense of pulling the tuner out and having it serviced or replaced before he could use the recorder. After much discussion he decided to cut his losses and buy a new set. He paid me for fitting the alternative biscuit, but I did not charge him for a fair amount of time I had spent determining what was wrong with the tuner. So it was a lossy situation all round.

Other problems have arisen with an early HMV model which used a General chassis and was called a "Deacon". These used a similar setup to the previous one, except that they used channel 11 as the alternative UHF input and supplied the set fitted with a UHF biscuit, with the channel 11 one as a spare. Unfortunately, in this area, channel 11 is used as a translator, meaning that the set has to be modified and the UHF biscuit fitted in some other blank position.

Another problem involving this same model set is that, because the UHF tuner is usually never touched, the tuning capacitor "freezes" and it is impossible to turn it. Getting the tuner out and getting the rotor shaft moving again is both time consuming and tricky, particularly as it would be all too easy to wreck the capacitor if one was too heavy handed. So, once again, the customer is up for additional expense before he can get his recorder working.

Finally, there is another very nasty trap, which tricked me for a while when I first encountered it. The recorder was National model which the customer had used in the Sydney metropolitan area for a couple of years before moving down the coast to my area. My first encounter with it was when he called me in to find out why he couldn't adjust the recorder tuner to channels 4 and 5A.

The tuner used the usual varicap system and I could see no reason why there should be any problem. Nevertheless, I was unable to get it anywhere near channel 4, and could only reach the edge of 5A. Fortunately, before I could organise to get the thing back to the workshop and open up the tuner, the owner happened to mention that he had bought it in Singapore.

The penny dropped. A lot of the sets sold in these Asian markets suffer from this problem. While the salesman will go to great lengths to assure the customer that these recorders are suitable for the Australian PAL system, with 5.5MHz sound/vision separation, they either don't know, or carefully avoid mentioning, that the tuners are designed for the European market.

As such, they are incapable of being tuned to channels 0, 1, 3, 4, 5 and 5A. Which means that, if you live in one of the capital city areas, you may never be aware of this limitation – unless you are a channel 0 buff – until you retire and move to the country.

No easy solution

What's more, there is no very easy solution to the problem. The local National organisation is not in a position to supply an alternative Australian tuner which I felt could be fitted readily enough, since the two appeared to be physically compatible. (Just why they cannot be made available is not clear, but no doubt they have their reasons).

In this case it so happened that I was able to acquire such a tuner through channels which will have to remain nameless, even though the transaction was perfectly legitimate. This was duly fitted without any serious hassles, and worked first time. However, the whole deal had set the customer back around $150, which took some of the glitter off the bargain price he had paid in Singapore.

So, "let the buyer beware."

In fact, this fellow was lucky. When I first approached the gentleman who ultimately supplied the tuner, and explained why I wanted it, he agreed that he could supply a tuner, but expressed the opinion that it wouldn't work. When pressed for a reason for this opinion he related a story about another similar situation where he had supplied a tuner to solve what was, apparently, a similar problem.

Unfortunately, in this case, it didn't solve the problem, the recorder being unable to receive any sound. In the end, a new IF strip had to be fitted by which time the cost had risen to an alarming degree. As I explained to him, I had little doubt that this was a case where the customer had inadvertently purchased a recorder intended for the British market. Not only would the tuner be totally useless, being UHF, but the sound separation would be 6MHz instead of 5.5MHz.

Not much of a bargain really.

EA Effects Unit

To finish off, here is a letter from J.A. of Inverell, NSW. He explains that electronic servicing is not his usual field, but that he has been "dabbling" in it for about 25 years, mainly in audio and electronic controls. He is currently involved in computers, interface equipment and data gathering. His letter was prompted by an unofficial service job involving an EA project. He writes:

A young musician in my district had assembled a kit of the EA Effects Unit (June 1983), bought from one of the major kit suppliers. His story was that, on powering up for the first time, there was a puff of "steam" from one of the tantalum capacitors. After replacing this with a new one (with the correct polarity this time) the unit still did not work and his main concern was that the BBD (Bucket Brigade Device) was damaged. He was reluctant to buy a new one unless it was needed as they cost around $16.

I felt that the incorrectly wired capacitor was not likely to have damaged the BBD, and agreed to help. The assembly seemed to have been done in a competent fashion and a quick check with the CRO confirmed that the clock and the BBD appeared to be functioning normally. A sine wave fed into the input socket was available at the output, albeit very attenuated.

Thus encouraged, I fed in a music signal and found that the single or echo function operated correctly, which seemed to exonerate most of the electronics, but that selecting reverb caused no change to the signal at all. A glance at the selector switch showed what seemed to be the problem; the type supplied in the kit was different from that illustrated in the instructions, and the wiring had been thoroughly

confused. A few minutes work sorted that out but there was still no change to the reverb function.

The circuit shows that the reverb loop includes the output amplifier (IC5) and, as I had already noted that the gain was down, I assumed that there was insufficient signal being fed back from the output for reverb to occur. A quick check confirmed that this stage was in fact attenuating the signal by around 10dB.

A check of components, in-circuit, with a multimeter showed the three 10kΩ resistors in series with the inverting input to be correct, but the 22kΩ feedback resistor measured low. As it appeared undamaged and was clearly marked with the correct value, I suspected that a wiring fault or damaged capacitor was causing a false reading.

Careful inspection of the board revealed no such damage, so one end of the 22kΩ resistor was lifted out of circuit. It measured 2kΩ – little wonder that the IC was not amplifying! It was a common 5% half-watt type with a light painted body, clearly marked red-red-orange (not burnt red either) so I was forced to the conclusion that it had been incorrectly marked during manufacture.

Needless to say, substitution of a correct value restored the lost gain and made the unit wholly functional, much to the delight of the owner. This is the first time I have encountered a new resistor with its value incorrectly marked and, although it must be quite rare thanks to manufacturers' quality controls, it is a possibility we need to bear in mind.

Thank you J.A. for a most interesting story, and one which carries some kind of a message for all home constructors – and perhaps servicemen too, come to that. Many home constructors I know insist on measuring all resistors and capacitors on an RC bridge before they fit them, regardless of their source.

And, I understand, it is surprising how often a component with a fault of some kind is found. Granted, it may be only one in a whole kit, consisting of dozens of minor components, but it can lead the constructor a merry dance once it is in circuit. As one of them put it, "if you check them all as they go in, they are the last thing to worry about if the device doesn't work, and it narrows down the suspects considerably".

As for the wrongly marked resistor itself, I agree that this is a puzzle, although I have encountered a couple of these myself over the years. How does it happen? Quite frankly, having seen resistors being made on modern automated production lines, I would have been prepared to swear that it couldn't happen, had it not been for the hard evidence encountered by both myself and J.A.

When resistors are made they enter a machine as blanks at one end and are trimmed to value, bridged, rejected if out of tolerance, and finally painted and colour coded, the latter via wheels or jets charged with the appropriate colour. And all without human intervention.

So how can a single wrongly coded resistor be created? A wrongly charged colour wheel or jet is, of course, conceivable, but this would produce a whole batch of wrongly coded units, with resultant confusion right through the industry.

But wait a minute. Suppose that such a mistake was made and a batch, or even a small part of a batch, was produced before the mistake was noticed. The manufacturer's immediate reaction would be to collect all the faulty units and either destroy them or arrange to have them re-processed, which ever he felt was most economical.

The only snag is that one or two of these could easily escape the collection process, and eventually find their way into stock where they would be binned according to their face value.

Well, that's the only explanation I can offer.

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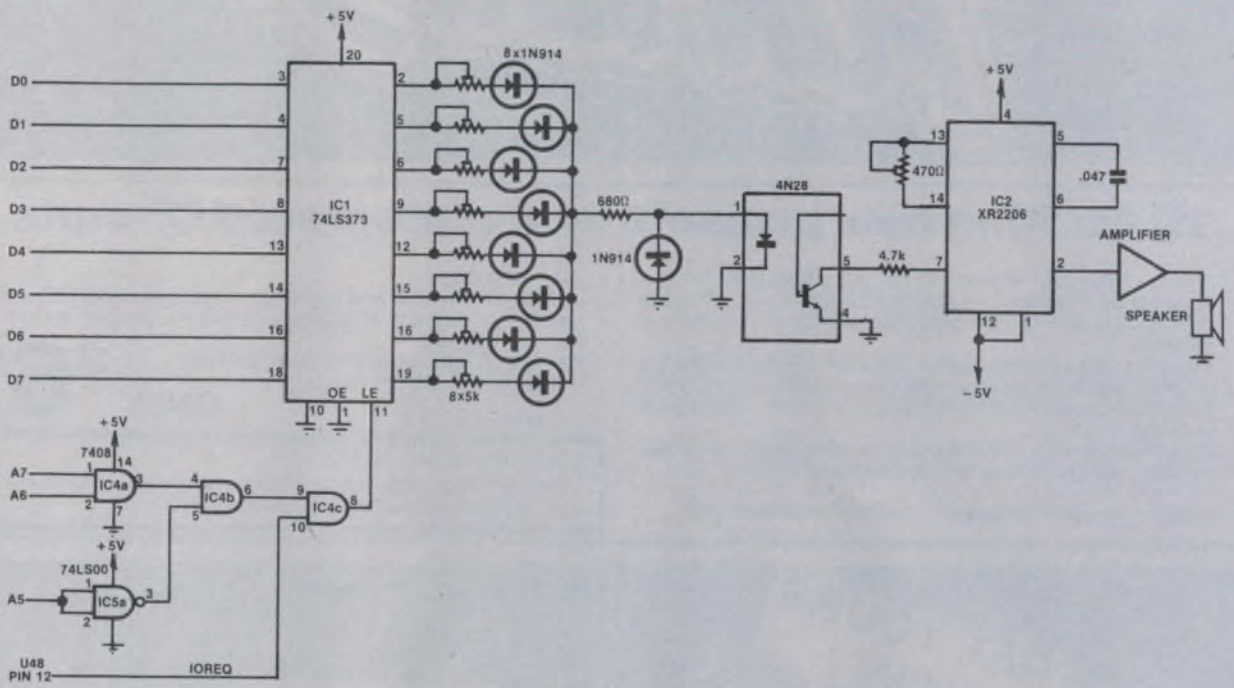
Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.



Tone generator for Super-80 computer

Readers who built the Super-80 computer may be interested in this programmable tone generator.

At the heart of the circuit is an XR2206 function generator IC (IC2). This IC normally produces a triangle wave output but, in this application, has been wired to produce a sinewave output by connecting an external pulse-shaping resistor (470Ω trimpot) between pins 13 and 14. In practice, the trimpot is adjusted to give the lowest distortion.

The output frequency is controlled by a transistor inside optocoupler IC3 which simply varies the current flowing from pin 7 of IC2. The current through the transistor is dependant upon the LED brightness and this is set by the current flowing through the 5kΩ trimpots connected to the outputs of a 74LS373 8-bit latch (IC1). IC4 and IC5 provide address decoding for the latch enable (LE) pin of IC1.

The prototype was built on a double-sided PCB which plugs directly into the onboard S100 slot. This board was fitted with separate 5V voltage regulators. The connection from pin 12 of U48 can be run to an unused pin on the S100 socket.

Setting up is simple. Send the values 1, 2, 4, 8, 16, 32, 64 and 128 in turn to the latch at address 222D and adjust the trimpots to give the desired tones.

N. Clark,
Wynnum North, Qld.

$15

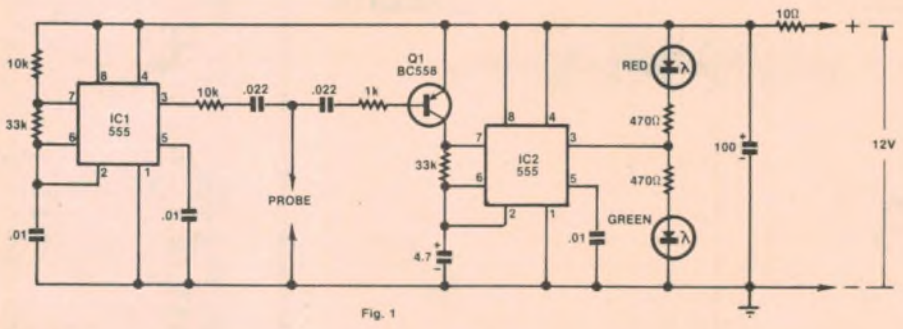
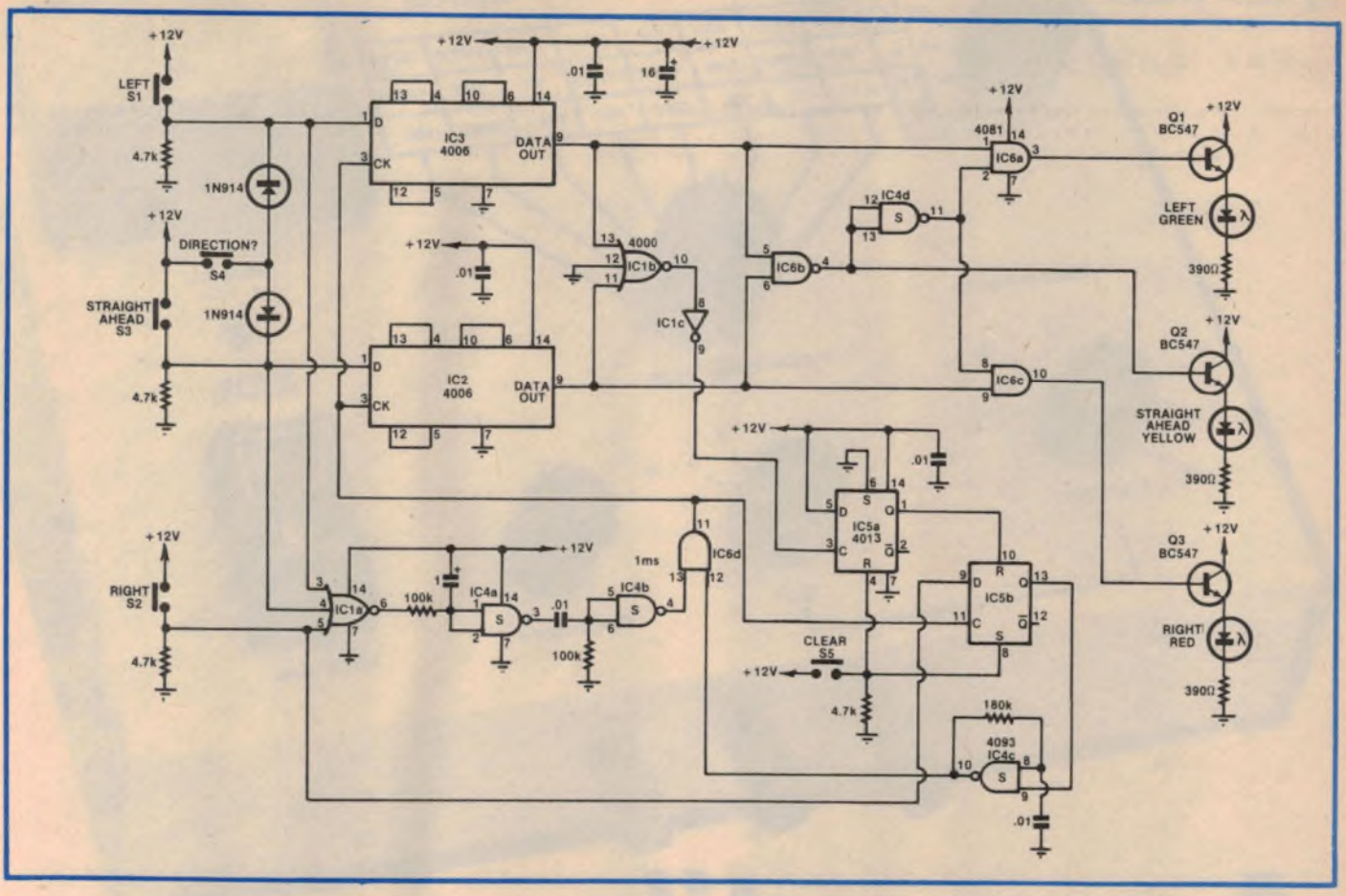


Fig. 1

Fluid level detector

This circuit was originally designed to detect low fluid level in a vehicle radiator, although it could also be used as a "tank filled" or "tank empty" indicator. The circuit is straightfoward and uses two 555 timer ICs.

To eliminate the problem of electrolysis, AC current is applied to the probes. 555 timer IC1 operates as a 1kHz astable oscillator, the output of which is AC-coupled to the level probe and also



Simple car navigation aid

When reference has to be made to a street directory it can be difficult to remember the sequence of directions for the journey. With this device, the driver can program the route into two shift registers. Thereafter, if the direction switch is pressed at each intersection, the device will light one of three LEDs to indicate left turn, right turn or straight ahead.

It works like this. The device is programmed using switches S1, S2 and S3. Each time a switch is pressed, data is clocked into the shift registers (IC2 and IC3). Subsequently, when direction switch S4 is pressed (ie, when an intersection is approached), data is clocked out of the shift registers and decoded by gates IC6a, IC6b, IC6c and IC4d. These gates, in turn, control LED-driver transistors Q1, Q2 and Q3.

IC1a, IC4a and IC4b provide the necessary pulses to clock data into and out of the shift registers. When any of the switches S1-S4 is pressed, the output of IC4a goes high and applies a 1ms positive-going pulse to IC4b via a .01uF capacitor. This pulse is inverted by IC4b and gated through to the clock inputs of IC2 and IC3 by IC6d.

S5 is used to clear the contents of the shift registers before programming commences. It works with D flipflop IC5b to enable Schmitt trigger oscillator IC4c, the output of which then clears the shift registers by rapidly clocking data out. IC1b, IC1c and IC5a provide an automatic clear function at the end of the programmed sequence (ie, when the outputs of both shift registers are low).

G. Argall,
Lilydale, Vic.

$20

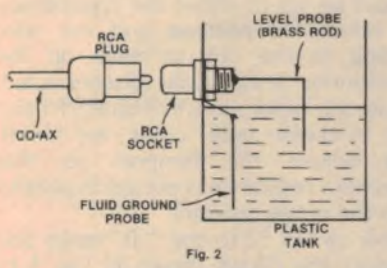


Fig. 2

to the base of transistor Q1. Q1, in turn, controls 555 timer IC2 which is a LED flasher circuit.

When fluid is in contact with the level probe, the output of IC1 is shunted to ground and Q1 is off. Thus, the output of IC2 is high and the green LED lights to indicate that the tank is full.

When the water level drops below the probe, Q1 is switched on and off at a 1kHz rate and supplies current to IC2's RC timing network. IC2 now functions as a 1Hz astable oscillator which alternately flashes the red and green LEDs.

Note that the fluid in the tank must be at ground potential for the circuit to work. If the tank is make of metal, it can be connected to the circuit earth and a single probe used to detect the fluid level. If the tank is made of plastic, it will be necessary to add a fluid ground probe as shown in Fig.2.

Finally, if the unit is to be installed in a vehicle, use RG-58U coax for the probe cable and connect the shield to the circuit earth. This measure will prevent false triggering due to ignition spikes. You will also have to fashion a suitable radiator probe.

P. Mann,
Robinvale, Vic.

$15

by JEFF SKEEN

A versatile LCR Bridge

PART 3

—for laboratory & workshop

In this third and final article on our LCR Bridge we present the calibration procedure and give instructions on how to use the bridge in its various measurement modes.

Assuming that you have constructed our new LCR Bridge there remains the final task of calibration. This is a fairly easy and straightforward procedure although care should be exercised since ultimately the accuracy of the bridge depends upon it.

Superficially, a design such as this should have little need for calibration. After all, close tolerance standard components are specified. However, all those switches and wiring inevitably add resistance to the circuit as well as stray capacitance. We have already talked (last month) about the measures used to minimise stray capacitance. Resistance is another matter and is taken into account by the calibration procedure.

The first step then is to adjust the lowest value range resistors, via VR2 and VR3. The procedure requires an adjustable power supply and two multimeters which should preferably be digital types since they have the best resolution and accuracy.

To isolate the range resistors, switch S1 should be set to either the capacitance or inductance position and the wire leading to the 16Ω terminal on the transformer temporarily disconnected. Rotate the wiper screws of both VR1 and VR2 clockwise until "clicks" are heard. This adjusts the trimpots so that maximum resistance is placed in parallel with the range resistors.

Now switch S2 to the "1Ω" range and connect the circuit shown in Fig. 1 to tests points TP1 and TP2. These test points are shown on the circuit diagram on page 46 of last month's issue and on the accompanying wiring diagram on page 47.

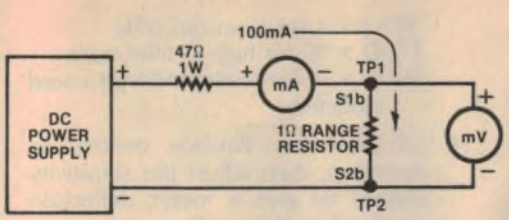


Fig. 1

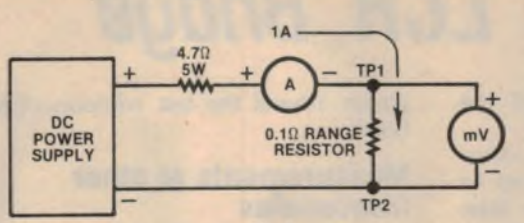


Fig. 2

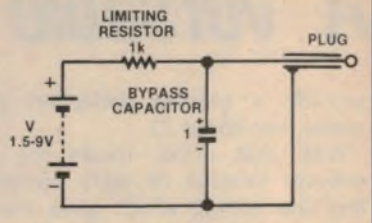


Fig. 3

Switch on the power supply and adjust the output voltage until 100mA flows through the 1Ω range resistor. This will be indicated by the meter which, if it is a DVM, should be set to the 200mA range. Then rotate the wiper screw of VR3 until the voltmeter (DVM set to 200mV) indicates 100mV. It may be necessary to adjust the power supply voltage slightly to maintain the current at 100mA during the adjustment of VR3.

That is all that is required to calibrate the "1Ω" range. The procedure for the "0.1Ω" range is very similar. This time though we use the circuit of Fig. 2 which shows a 4.7Ω/5W resistor instead of a 47Ω/1W resistor.

Set S2 to the "0.1Ω" range and adjust the power supply output voltage to provide a current of one amp through the circuit. If the ammeter is a DVM it should be set to the 2A range. VR2 is then adjusted until the voltmeter again reads 100mV.

This completes calibration of the 0.1Ω range. Remove the circuit used for calibration of the range resistors and solder the lead back on the transformer 16Ω tag.

The next step is to adjust the 1kHz oscillator. Disconnect one of the null meter leads (this spares the meter from possible long periods of overload) and connect a multimeter between ground and the output of IC1c. Set the multimeter to an AC volts range greater than 10V and switch the LCR bridge on (either battery or AC power).

Depending on the initial setting of VR1, the multimeter may or may not indicate a reading. In either case, VR1 should be adjusted so that the multimeter reads zero (ie no oscillation) and then VR1 should be slowly turned until the multimeter reads beween four and five volts. Turn VR1 a shade further to ensure reliable start-up of the oscillator, and adjustment is complete.

If the oscillator refuses to start the most probable reason is lack of range in VR1. Replace VR1 with a 500Ω potentiometer and repeat the oscillator adjustment procedure. If the oscillator still refuses to start, the most likely cause is incorrect or out of tolerance components in the oscillator circuit. These should be located and replaced.

If you have access to a frequency counter you may wish to trim the oscillator frequency to exactly 1kHz. Adjustments are made by changing the .0018μF capacitor to a higher or lower value. Increasing the .0018μF capacitor to .0022μF will lower the oscillator frequency by about 10Hz while decreasing the capacitor to .0015μF will increase the oscillator frequency by about 10Hz.

The final calibration step involves adjusting out the DC offsets of IC3 and IC4.

Temporarily unsolder the wires leading from S1 to the inputs of IC3 and IC4 and in their place run a wire from each op amp input to a grounded PC pin. Connect a multimeter set to the 200mV range between the grounded PC pin and the output of IC3. Set S1 to the Rdc position, turn the LCR bridge on and rotate the sensitivity control to half maximum. Adjust VR4 so that the multimeter reads zero then increase the sensitivity control to maximum and again adjust VR4 so the multimeter reads zero.

The last adjustment may be a little touchy since with the sensitivity control set to maximum the op amp is amplifying changes in the offset voltage by 150 times. Some small random variations in the output voltage will be noticed at maximum sensitivity. These are due mainly to amplified noise and can be neglected since they will average out to zero.

The multimeter lead should now be swapped over from the output of IC3 to the output of IC4 and the sensitivity control set back to half. The adjustment procedure detailed for IC3 is now repeated for IC4. Following this, the multimeter should be connected between the outputs of IC3 and IC4. With the sensitivity control set to maximum the voltage should be almost zero ie, less than ±3mV (except for small noise variations). Both IC3 and IC4 are now adjusted for minimum offset voltage.

This completes the calibration procedure. The null meter should be reconnected and the grounding wires at the IC3 and IC4 inputs removed and the original wires from S1 reconnected. The final step is to place a small dot of white paint on the digital readout between the first and second digits to act as a decimal point. When turned to the zero position the display should read 0.00. The LCR bridge is now ready to use.

Using the bridge

A bridge such as this may seem a little daunting to use at first when compared to measuring components with digital capacitance meters and the like. Instead of just bunging the component across the terminals you also have to twiddle the dials.

So how do you go about measuring components with the bridge? To make things simple it is a good idea to first rotate the DQ control to its minimum setting. A low setting, almost fully anti-clockwise, should also be used for the sensitivity control. If you use a high setting initially the meter will inevitably be hard off scale.

Incidentally, the meter deflection will always be to the right of zero for AC measurements (AC resistance, capacitance and inductance) but for DC resistance measurements it will swing through zero as the null or balance point is passed. When the meter needle is to the left of zero the resistor value is lower than the bridge setting; when the meter needle is to the right of zero the resistor value is higher than the bridge setting.

So for DC resistance measurements the null condition will be in the centre of the meter scale and the meter pointer will swing either side of zero as the null condition is approached.

For AC measurements the null condition is as close to zero on the meter scale as you can get it and if you are not at the null condition, the meter pointer will be deflected to the right.

Now connect the unknown component to the terminals on the front of the bridge. Make sure that you are making a good connection to both leads of the component. With some types of binding post terminals we have found that the only way to make sure of a good connection is to pass the component leads through the holes in the terminal posts and then screw them up tightly.

Switch the bridge on and rotate the mode selector to C, L or R (AC or DC) depending on the type of component being measured. Set the digital vernier control to about half scale; eg, around 5.00. Now set the sensitivity control to

A versatile LCR Bridge

provide a modest deflection of the meter, say about 25.

With that done, rotate the range selector through its eight positions to find the setting which gives the least pointer deflection (ie, the closest to zero). Now rotate the vernier control to the setting which gives the minimum pointer deflection. You will find that as you approach this null, you will have to rotate the sensitivity control clockwise to give more meter deflection.

This process is continued until you have the best null condition, ie, the pointer as close to zero as you can get it with the sensitivity control at maximum clockwise setting. Then, and only then, do you try manipulating the DQ control if you are measuring a capacitor or inductor. For the majority of capacitors, with the exception of electrolytics, the dissipation value will be almost negligible.

Once you have achieved the best null possible, you have to read the component value off the bridge. This is done by multiplying the setting of the digital vernier control by the setting of the range multiplier. For example, if the range multiplier is set to "0.1μF" (for capacitance) and the vernier reading is 4.73, the capacitor value is 0.473μF.

If you have used the range extension switch which adds "1.00" to the reading, the previous value would become 5.73 $\times$ 0.1μF which equals 0.573μF.

The procedure for measuring resistors and inductors is similar and is outlined in step-by-step form at the end of this article.

Residual capacitance

When measuring capacitors on the 100pF range, the residual capacitance of the bridge must be removed from the reading otherwise an unacceptable error may result. To do this, the bridge is first balanced with the terminals open circuited to obtain the bridge residual capacitance, then the unknown capacitor is measured. The residual capacitance is then subtracted from the bridge reading to obtain the true component value.

The bridge has the option of being powered either by batteries or 12VAC (or both). When AC is connected to the bridge the best null may not be as low as when batteries alone are used. This is due to stray capacitance between the test component, the mains and ground inducing a spurious 50Hz signal across the component. The effects of this signal may be minimised by running a wire between the case of the LCR bridge and mains earth or by placing an earthed screen around the test component (or both).

Measurements at other frequencies

Measurements of capacitance, inductance and AC resistance may be carried out at frequencies other than 1kHz by connecting an audio oscillator with a maximum output of 2V RMS to the EXT AC EXCITATION socket. Be careful not to exceed the maximum signal voltage as this can lead to an incorrect null being obtained. When using frequencies other than 1kHz, multiply the D and Q scales by a factor of f/1000, where f is the signal frequency in Hz.

External bias

A polarising DC voltage may be applied to the capacitor under test via the "Ext DC Bias" socket. Application of a DC bias generally does not cause a large change in capacitance (a 1% change would be typical) unless the bias is left on for a long period. The bias supply needs to have a limiting resistor to prevent possible damage to the range resistors if the capacitor under test becomes short circuit, and a bypass capacitor to allow a low impedance path for the bridge energising signal.

A suitable schematic diagram for the bias supply is shown in Fig. 3. Using the voltage shown, the limiting resistor should be about 1kΩ while the bypass capacitor should be at least the full scale value of the range in use, or 1μF, whichever is larger, and of a suitable voltage rating.

The bias supply is connected so that the tip of the jackplug is connected to positive and the body is connected to negative. When the plug is inserted in the Ext bias socket, the Det +ve terminal of the bridge will be positive with respect to the Det –ve terminal and so the capacitor under test should have its positive lead connected to the Det +ve terminal. To prevent any possiblility of damage to the bridge, the bias supply should be disconnected before changing the bridge configuration or switching the bridge off.

Inductance measurement

1. Connect the unknown inductor between the Det +ve and the Det –ve terminals.
2. Set the component selection switch to inductance.
3. Turn the LCR bridge on.
4. Use the range multiplier switch to select the range in which the inductor value is expected to lie.
5. Set the DQ switch initially to:
   (i) Q $\times$ 1 for air cored coils,
   (ii) Q $\times$ 10 for high Q filter coils,
   (iii) D $\times$ 1 for laminated iron cored inductors.
6. Set the Loss Balance control to minimum, then adjust the sensitivity control to give a meter deflection under full scale.
7. Alternately rotate the digital readout knob and the loss balance control so that the meter deflection decreases. When necessary, increase the sensitivity control to provide a better null indication.
8. When there is no more range left in the sensitivity control, or it becomes impossible to obtain a lower meter deflection, the bridge is nulled. The component value is obtained by mutiplying the dial reading and the selected inductance range together as described previously.

Low Q inductors

For inductors with a Q less than 0.5, the bottom of the null flattens out and it may become impossible to find the minimum null point. This problem occurs mainly with low value RF inductors which have a fairly large series resistance in comparison to their inductance. The problem may often be circumvented by measuring the inductance at a higher frequency, say 10kHz. This raises the Q value by a factor of f/1000 (at 10kHz this equals 10) and so provides a better null.

High Q inductors

If an inductor has a Q higher than 31 at 1kHz it must be measured either at a lower frequency (to lower the Q) or on the D $\times$ 1 setting of the DQ switch. In this case, the D value of the inductor is read off the loss balance dial and the corresponding value of Q is found from Q = 1/D. In practice, the value of the loss balance dial will be too small to allow an accurate determination of D and so any calculated Q will be a "ball-park"figure only.

Inductor bias

Due to the non-linear characteristics of iron and ferrite core inductors it is sometimes necessary to know the incremental inductance of a coil at a particular operating point. This is done by using a DC bias current to bring the characteristic to a particular point on the B-H curve while measuring the inductance with a small AC signal.

The circuit shown in Fig. 3 is suitable for providing DC bias currents, the only changes being that an ammeter should be placed between the voltage supply and the limiting resistor to monitor the current and either the limiting resistor or the voltage supply should be made

variable so that the bias current can be varied.

AC resistance

1. Connect the unknown resistor between the Det +ve and the Det −ve terminals.
2. Set the component selection switch to AC resistance.
3. Turn the LCR bridge on.
4. Use the range multiplier switch to select the range in which the resistor value is expected to lie.
5. Set the sensitivity control to give a meter deflection of around three quarters full scale.

   There is no need to worry about the settings of the DQ switch and the loss balance control when measuring AC resistance since these controls are switched out of circuit. When measuring high value and wire wound resistors, series inductance and shunt capacitance components will cause the AC resistance (or impedance) to be different to the DC resistance (or marked value). For this reason it is usually better to measure these types of resistors using the DC resistance mode.
6. Rotate the digital readout dial so that the meter deflection decreases. When necessary, increase the sensitivity control to provide a better null indication.
7. When there is no more range left in the sensitivity control, or it becomes impossible to obtain a lower meter deflection, the bridge is nulled. The component value is obtained by multiplying the dial reading and the selected resistance range together as described previously.

DC resistance

1. Connect the unknown resistor between the Det +ve and the Det −ve terminals.
2. Set the component selection switch to DC resistance.
3. Turn the LCR bridge on.
4. Use the range multiplier switch to select the range in which the resistor value is expected to lie.
5. Set the sensitivity control to give a meter deflection of around three-quarters full scale.
6. Rotate the digital readout dial so that the meter deflection decreases. When necessary, increase the sensitivity control to provide a better null indication.
7. When there is no more range left in the sensitivity control or it becomes impossible to obtain a lower meter deflection the bridge is nulled. The component value is obtained by multiplying the dial reading and the selected resistance range together as described previously.

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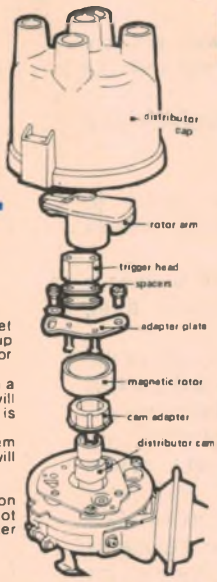

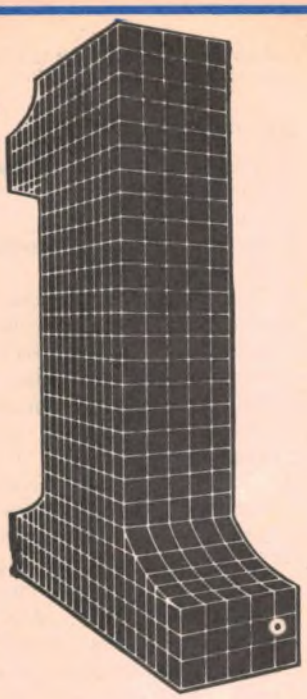

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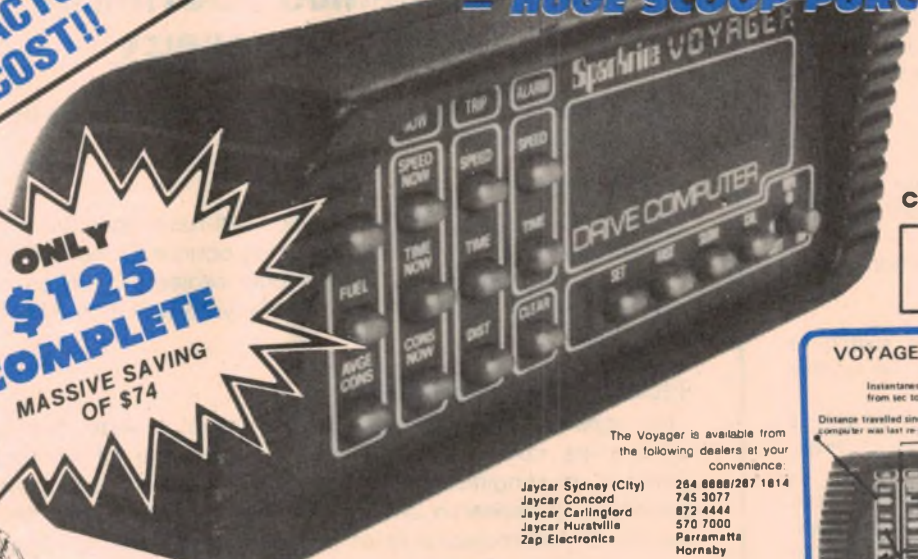

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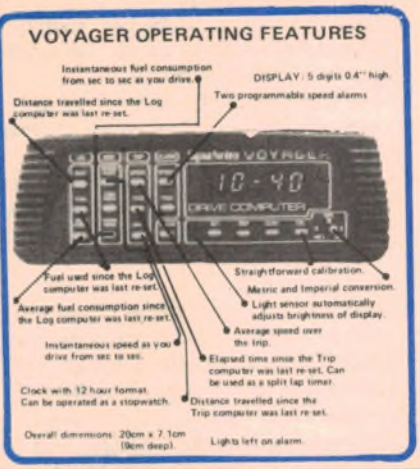

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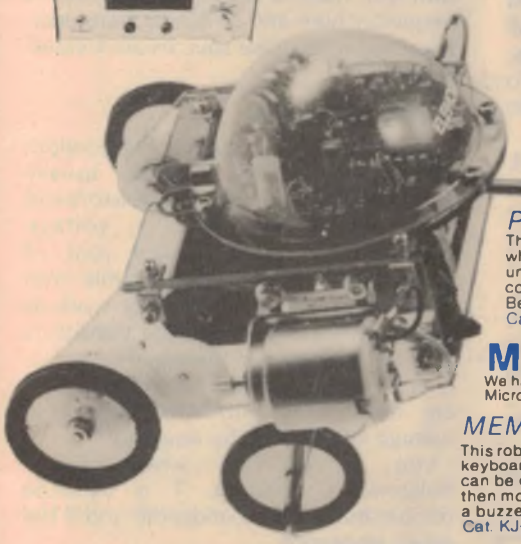

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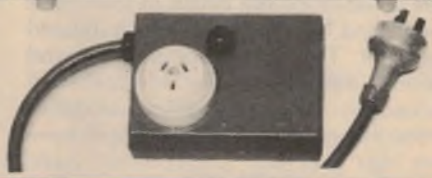

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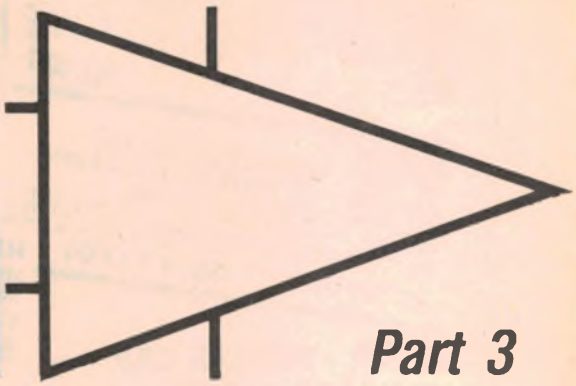


Part 3

High gain operational amplifiers are not known for their low noise performance. In this article, we examine the causes of noise and discover what can be done about it.

The proliferation of high gain linear integrated amplifiers in the market place has done wonders in promoting circuit designs of high accuracy and linearity. Unfortunately, such progress has done little to advance the cause of low noise design and in many cases has mitigated against it. The reason for this is found buried deep in the fundamental philosophy of the operational amplifier – that the amplifier block G should have very high gain. Fig. 1, a common basic circuit, is expanded in Fig. 2 to show the action of the differential first stage.

In part one of this series we saw that at x, the inverting input of a high gain amplifier G, the feedback action and the high open loop gain combine to produce a low effective impedance to ground (the "virtual earth") and a very low signal voltage. Typical values for the case of closed loop gain = 10 are given in Table 1. The three integrated circuits named are available over the counter from a number of manufacturers.

In the application given in Table 1, all three types will give excellent results as regards DC stability, gain stability, linearity, and low sine wave distortion. Note, however, that the signal level applied to the input of the long tail pair is measured in microvolts. It is well known that every semiconductor junction generates noise, again usually of the order of some microvolts. As the input point x is applied directly to the first transistor junction (ie, to the base), it follows that if the signal voltage at x is as small as the junction noise voltage, then we will have a very noisy amplifier.

Because of the high again of G, the basic operational amplifier is fundamentally noisier than other designs. This is no slight on any manufacturer nor on any integrated circuit type. It is a statement true for all operational amplifier configurations. However, there is no need to immediately consign all our hard-won integrated circuits to the dust-bin.

Looking again at Table 1, it is clear that, for volt-size inputs, the voltage at x is large enough to swamp the transistor junction noise into insignificance. Also, the table implies that the 301A integrated circuit should be less noisy than the very high gain 725 type in the same amplifier configuration. Note that Table 1 shows only typical open loop gain values for each type. For a manufactured batch of any one type, the open loop gain G can vary over a 2:1 or even 3:1 range, while G also changes with operating temperature.

TABLE 1

Ri	Rf	INTEGRATED CIRCUIT FAMILY TYPE	OPEN LOOP GAIN	VOLTAGE AT x Vin = 1V Vout = 10V	VOLTAGE AT x Vin = 1mV Vout = 10mV	VIRTUAL EARTH IMPEDANCE
1k	10k	301A	30000	330μV	0.3μV	0.3Ω
1k	10k	725	1000000	10μV	.01μV	.01Ω
1M	10M	545	50000	200μV	0.2μV	200Ω

The problem is, not all input signals are volt-size. Many signals are only of the order of a few millivolts or less, eg from phono cartridges, tape heads, microphones etc. To amplify these signals, we need to move away from the simple operational amplifier concept towards special low-noise designs.

It is agreed amongst the sages of this science that, in a semiconductor junction, there are three different effects, each a source of noise:

(a) Thermal noise, also called white or random noise;

(b) Shot or generation/recombination noise; and

(c) Flicker or 1/f noise.

The sum of all three is the noise we hear. (Other sounds can also interfere with our wanted signal, such as mains frequency hum and switching transients. These external noise sources are treated separately).

Thermal noise

Thermal noise is due to the random motion of charge carriers, usually electrons, in all conductors, resistors and semiconductors. Being a voltage proportional to the square root of bandwidth, we have little trouble with this effect for audio frequency work as long as we use good quality transistors and low resistance in the signal path. The high frequencies used for video signals are more of a problem. The noise voltage V(n) is actually equal to:

$V(n) = (4KTBR)^{\frac{1}{2}}$ where K is Boltzmann's constant, T is absolute temperature, B the bandwidth and R the series resistance.

Low noise designs

The basic idea of low noise design is simple: provide some gain in a very quiet amplifier stage ahead of the operational amplifier. If the operational amplifier sees a relatively high-level signal, noise will not be a problem. In order to design such a "front end" low noise amplifier stage, let's first consider the sources of noise in transistor junctions.

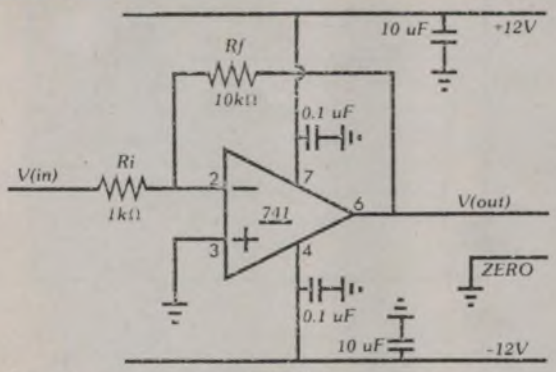


Fig. 1: basic operational amplifier circuit.

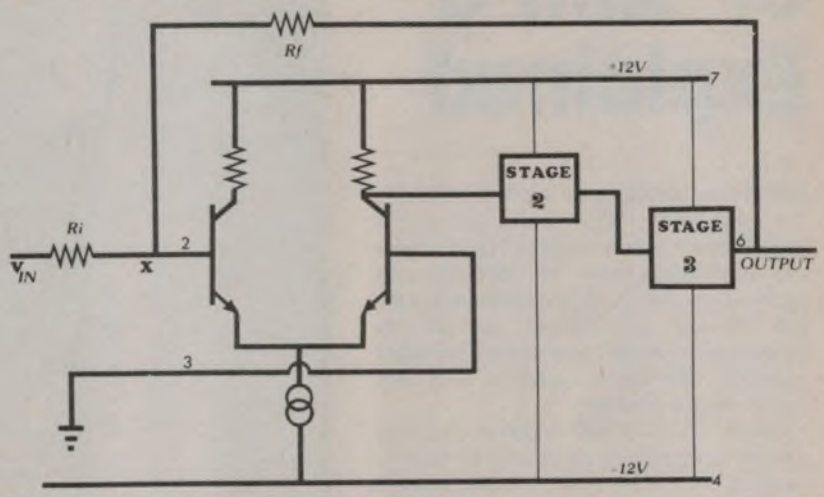


Fig. 2 (right): symbolic diagram of a common op amp IC showing the differential input stage. Ri is the input resistor, Rf the feedback resistor and 'x' the inverting input.

Incidentally, if resistors are used in series with the signal, they should be high-quality metal film or wirewound types. Never use carbon or composition types as these generate large amounts of noise due to their granular construction. In fact, experiments have shown that the "granular" noise generated by carbon composition resistors can be five times higher than the theoretical random noise of the same value resistor.

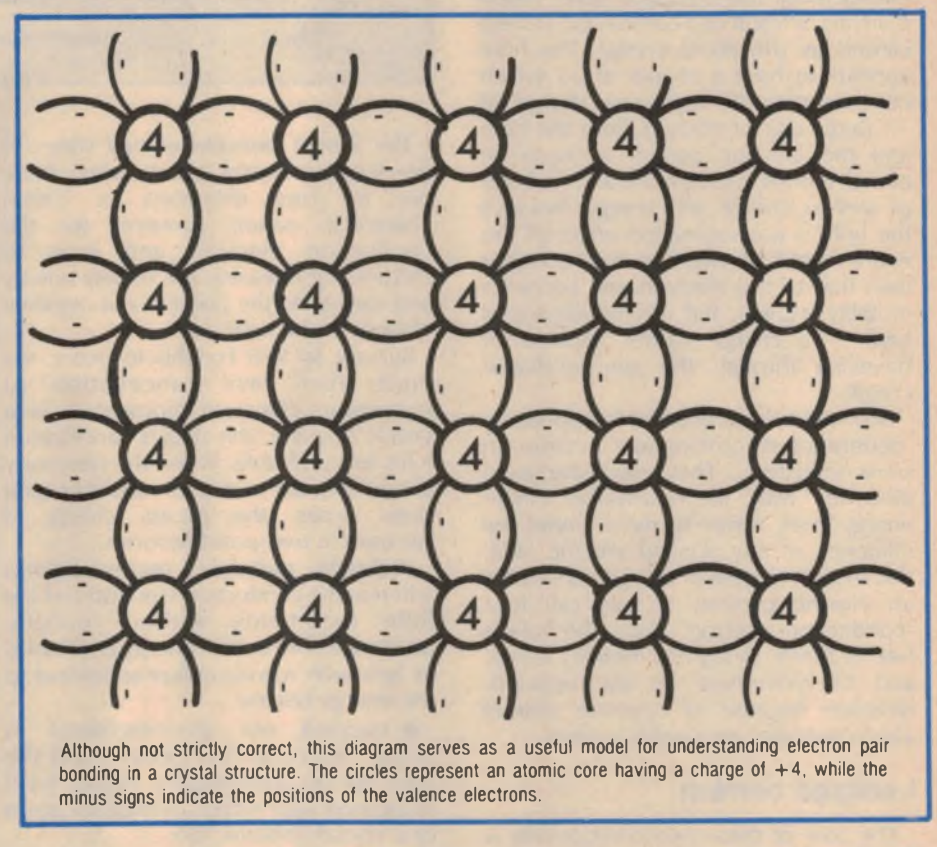
Shot noise

The generation of electron-hole pairs in a semiconductor, and their subsequent erratic recombination, is a second source of transistor noise, indeed the predominant one. To understand these effects, let's consider just what happens inside a semiconductor. Essentially, two separate actions occur simultaneously due to what are called the intrinsic and extrinsic properties of the semiconductor material.

The intrinsic properties of a semiconductor describe what goes on inside a pure crystal of semiconductor material, for example silicon, simply because the temperature is greater than absolute zero. In order to measure the intrinsic properties, it is imperative that the material be super-refined to no more than one impurity atom for every million million silicon atoms. Such super-pure silicon, in single-crystal, form exhibits the following true semiconductor properties:

- the conductivity is zero at absolute zero temperature because of the absence of charge carriers; and
- the conductivity increases as temperature increases due to the increase in the number of charge carriers.

The reason for this relation between the number of charge carriers and temperature is that, at absolute zero temperature, all electrons are busy



Although not strictly correct, this diagram serves as a useful model for understanding electron pair bonding in a crystal structure. The circles represent an atomic core having a charge of +4, while the minus signs indicate the positions of the valence electrons.

forming valence bonds, the structural ties which hold the solid material together as in Fig. 3. These valence bonds are essential, as they lock atoms together into the crystal shape.

The electrons have energy levels in a range known as the "valence band of energy levels". Such electrons are improperly called "valence electrons", an expression used by everyone (including your author), though it is strictly wrong because you cannot put name tags on individual electrons. At temperatures above absolute zero only a few electrons absorb thermal energy, the rest absorbing nothing.

Those that do absorb energy find it impossible to absorb just a little bit; instead they find they have to absorb a lot of energy or nothing at all. Having absorbed this energy, such electrons now find that they are able to break away from valence bond duty and wander off through the crystal. Their energy level can be anywhere within a range of energies called the "conduction band of energies".

The reason why they have to absorb a lot of energy to get into such a condition is that between the valence band of energies and the conduction band of energies is a great void, a range of energies which are not available to any electron. This void in the energy levels is

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called the "energy gap" and for silicon is 1.1 electron volts wide at room temperature as indicated in Fig. 4. If you are wondering why no electron can possess an energy level within this gap, the answer is that to do so its momentum would have to be a complex number, whereas in practice only real numbers are possible.

When an electron acquires thermal energy and moves to a higher energy level, if leaves behind one unoccupied energy level. This we call a "hole" which is, in fact, a result of a combination effect caused by the entire crystal. The hole appears to have a charge of +1 which complements the electron's charge of −1 (basic unit of charge). Both the hole and the electron appear to have an effective mass, momentum and mobility as well as charge and energy. Because the hole is a combination effect of the entire crystal, its effective mass is higher than that of the electron and hence its mobility is lower. Still, it is mobile and as such is a charge carrier capable of travelling through the semiconductor crystal.

Now we are in a position to appreciate "generation-recombination" noise in semiconductors. That much-discussed electron, with its new-found higher energy level, is free to move under the influence of any applied electric field, and this movement of charge constitutes an electric current. So we call it a "conduction electron". Also, the hole is free to move, though its mobility is less, and its movement (in the opposite direction because of opposite charge) also constitutes an electric current.

Leakage current

The sum of these two components is the leakage current or "saturation current" we observe in semiconductor diodes and transistors. Such leakage current is embarrassing in many aspects of circuit design and is one reason why silicon took over from germanium in the search for better semiconductor materials as it has less leakage current. The story we have just told is called "electron-hole pair" generation.

But worse is yet to come! You see, nature is "energy lazy" and always likes things to be in a state of lowest possible energy. That infamous "conduction electron", however, is in an elevated energy state, as is the hole. So the system is not in equilibrium.

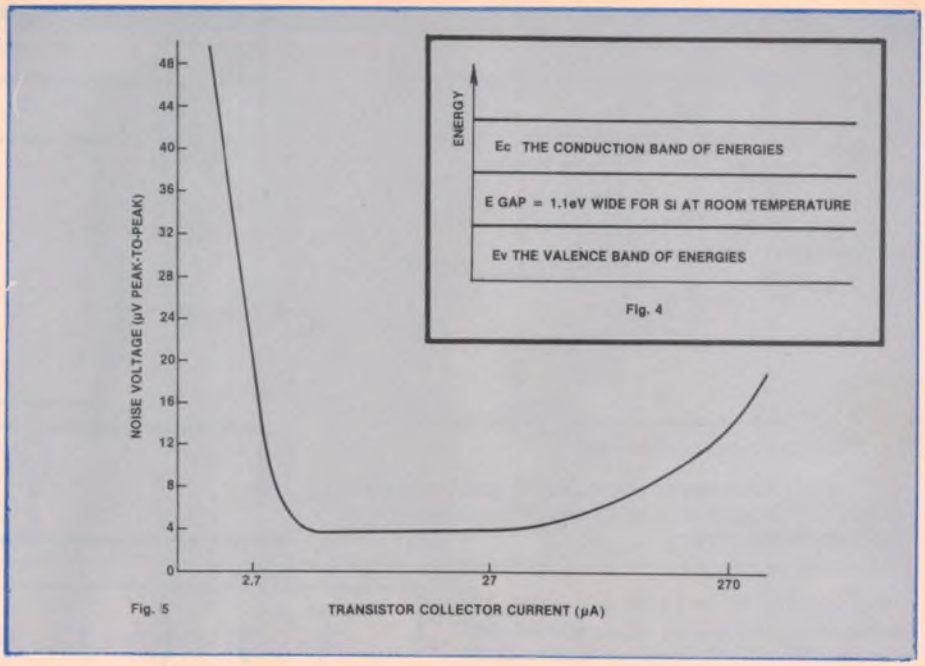

Fig. 5

The lowest possible energy state for the intrinsic crystal occurs when there are no free electrons or holes. Therefore, nature contrives for the conduction electron and hole to recombine, releasing the excess energy and cancelling the positive and negative charges in the process.

But not so fast! For this to occur, we must also have cancellation of momentum. Because momentum is a vector quantity, this makes cancellation a lot less probable. When the necessary conditions are met and recombination does occur, the excess energy is released in two possible forms:

- direct radiative recombination wherein the conduction electron and the hole recombine without outside assistance. The excess energy is released as light with wavelength proportional to the energy release.
- trapping site recombinations in which the conduction electron and the hole use an intermediary energy level associated with either an impurity atom or a crystal imperfection.

William Shockley, soon after inventing the transistor, realised that direct radiative recombination was almost insignificant compared to the more numerous trapping site recombinations, the traps being energy states due to impurities or crystal dislocations. Such energy states usually lie deep in the energy gap.

Recombinations also produce a small voltage signal in the semiconductor. Because many recombinations go on every second in a semiconductor, apparently arbitrarily, the voltage signals so generated appear as a never-ending string of pulses of random amplitude, randomly spaced in time. This we call "shot" or "popcorn" noise. The fact that it is by far the largest source of noise forces us to consider it seriously.

Transistors, as you know, are made of "doped" semiconductor material, ie silicon to which other elements such as aluminium, gallium, indium, arsenic phosphorus or antimony have been deliberately added. Such doping does marvellous things to the energy gap and makes transistor action possible, thus giving rise to the "extrinsic" properties. But still the intrinsic generation-recombination noise phenomena persists in all transistors to plague us.

Design precautions

For the integrated circuit and transistor designer, minimisation of generation-recombination noise means a reduction in the number of trap sites present. A reduction in the impurity content (eg of elements such as copper) and a reduction in the number of crystal imperfections both help in this regard. The former requires better silicon purification before doping. The latter demands greater care in manufacture and subsequent handling to minimise crystal dislocations, as well as careful design of the crystal slice shape.

In addition, it has been found that high current gain goes hand-in-hand with low noise. This is not surprising as the small base volume associated with a high gain transistor provides less opportunity for recombinations.

For the circuit designer, shot noise reduction involves choosing low-noise integrated circuits and transistors; high h_{FE}; choice of optimum collector current; and minimisation of the number of semiconductor junctions present. This latter statement outlaws Darlingtons,

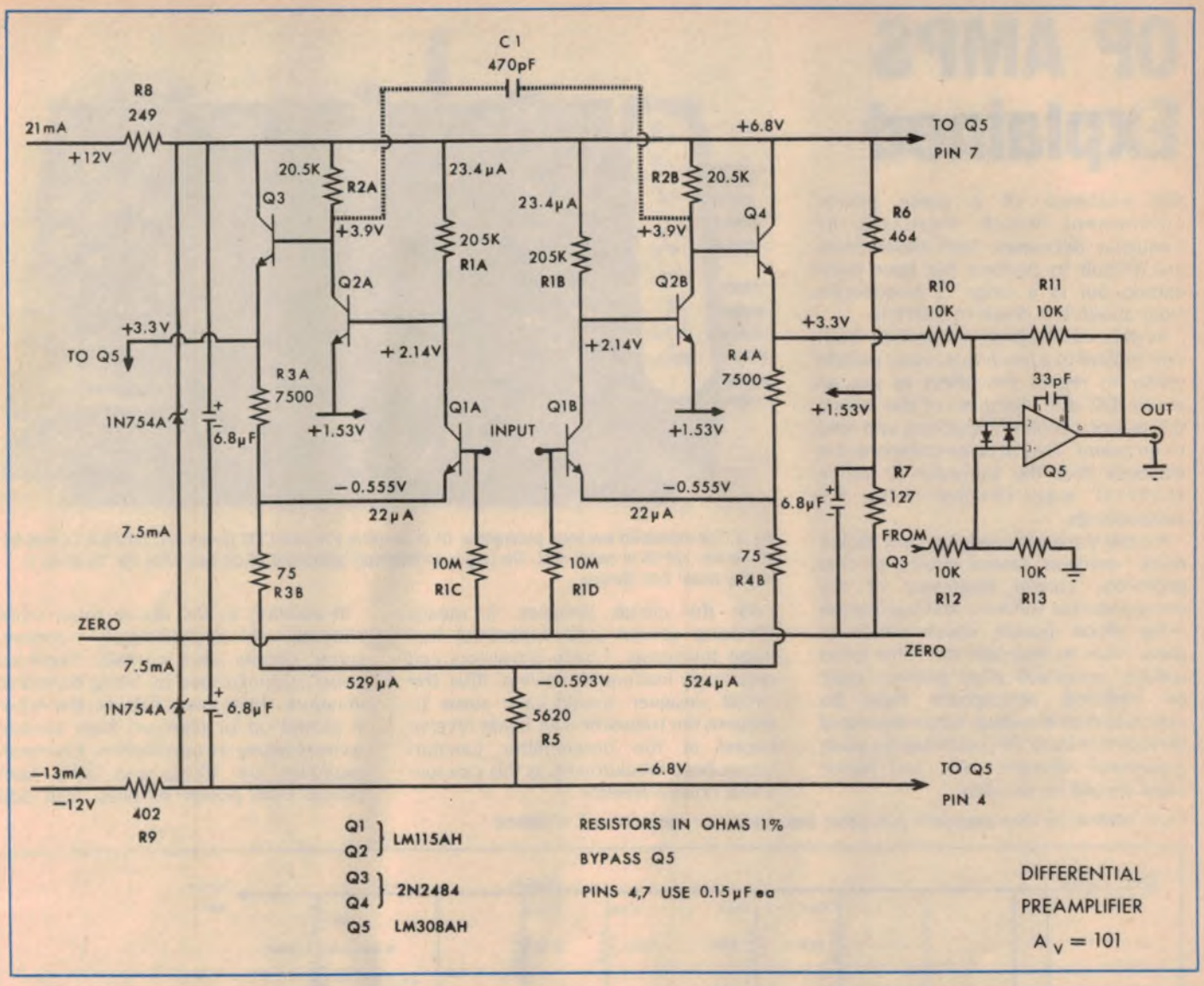

Fig. 6: Practical low noise preamplifier with closed loop gain = 101. Low noise results from moderate open loop gain (9000), avoiding the very small "voltage at x" problem.

super-beta transistors and active "tail" circuits. As field effect transistors are in general noisier than bipolar junction transistors, FET's should be avoided if at all possible. To prevent extra noise being generated because of a drop in h_{FE} at high frequencies, the circuit designer should start with transistors capable of high h_{FE} at frequencies much higher than the intended passband.

Flicker noise

Sometimes also referred to as "excess noise", flicker or 1/f noise is a surface phenomenon caused by the random trapping of charge carriers in fast surface energy states. Recall what we said about crystal imperfections or "faults" as trapping sites. Well, imperfections are also created in the surface of the crystal simply by using a saw to cut the crystal into slices. Experiments have established

Low-noise preamplifier PCB design

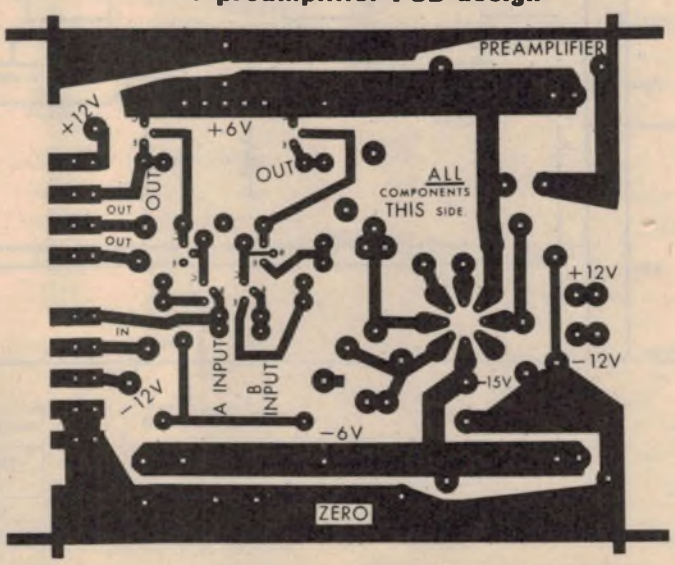

Fig. 7: actual size PCB design for the low noise preamplifier shown in Fig. 6. Note that, in this instance, the components are mounted on the copper side of the board. Component positions can be gleaned from Fig. 8.

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the existence of a noise power component which increases as frequency decreases. Such experiments are difficult to perform but have been carried out in a range of frequencies from about 1Hz down to .0001Hz.

As this corresponds to periods from one second to a few hours, many people prefer to regard this effect as just an erratic DC drift. Because of this effect, the use of coupling capacitors can lead to problems. This 1/f noise component is evidence that the transistor is not in thermal equilibrium with its surroundings.

For the transistor designer, low flicker noise involves careful choice of chip geometry, careful treatment of the semiconductor surfaces, and passivation using silicon dioxide, silicon nitride or glass. Also, to maintain the initial good surface, unwanted alloy growths must be inhibited; atmosphere must be excluded during sealing, future ingress of atmosphere must be prevented by using glass-metal hermetic seals, and plastic cases should be avoided.

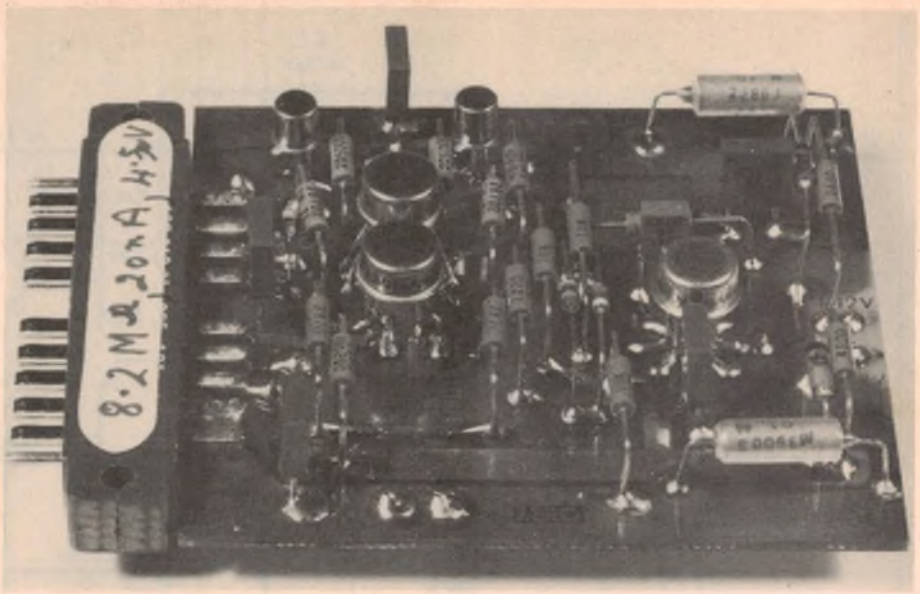
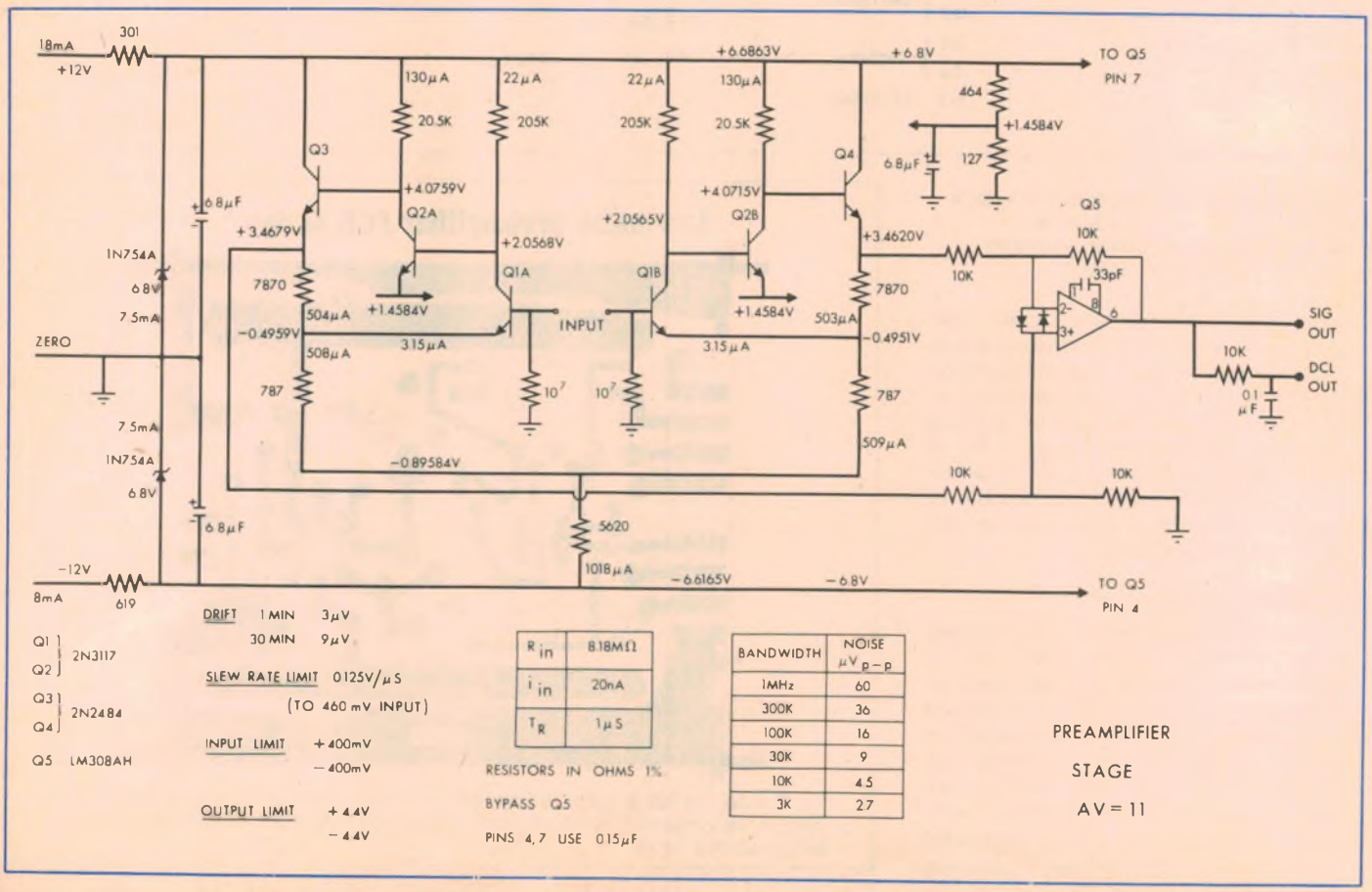


Fig. 8: The assembled low noise preamplifier. Q1 is at centre foreground, Q2 immediately behind it, Q3 and Q4 at rear left, and Q5 at centre right. The plug is an Amphenol gold plated 10-pin type. Note that the photo is slightly larger than life-size.

For the circuit designer, it means choosing special (and expensive) low noise transistors. Cheap transistors can only imply inadequate sealing. Also, the circuit designer should take steps to prevent the transistor ever being reverse biased at the base-emitter junction (zener base breakdown), as this can ruin a low noise transistor.

In addition to the above three noise sources, all approximately random, some circuits also contain "received noise", distinguished by being harmonic in nature. As its name implies, this noise is picked up or received from outside sources acting as transmitters. Common examples are 100Hz and 50Hz hum pickup from power supplies; high odd

Fig 9: Practical low noise preamplifier with closed loop gain = 11. Maximum input = 400mV



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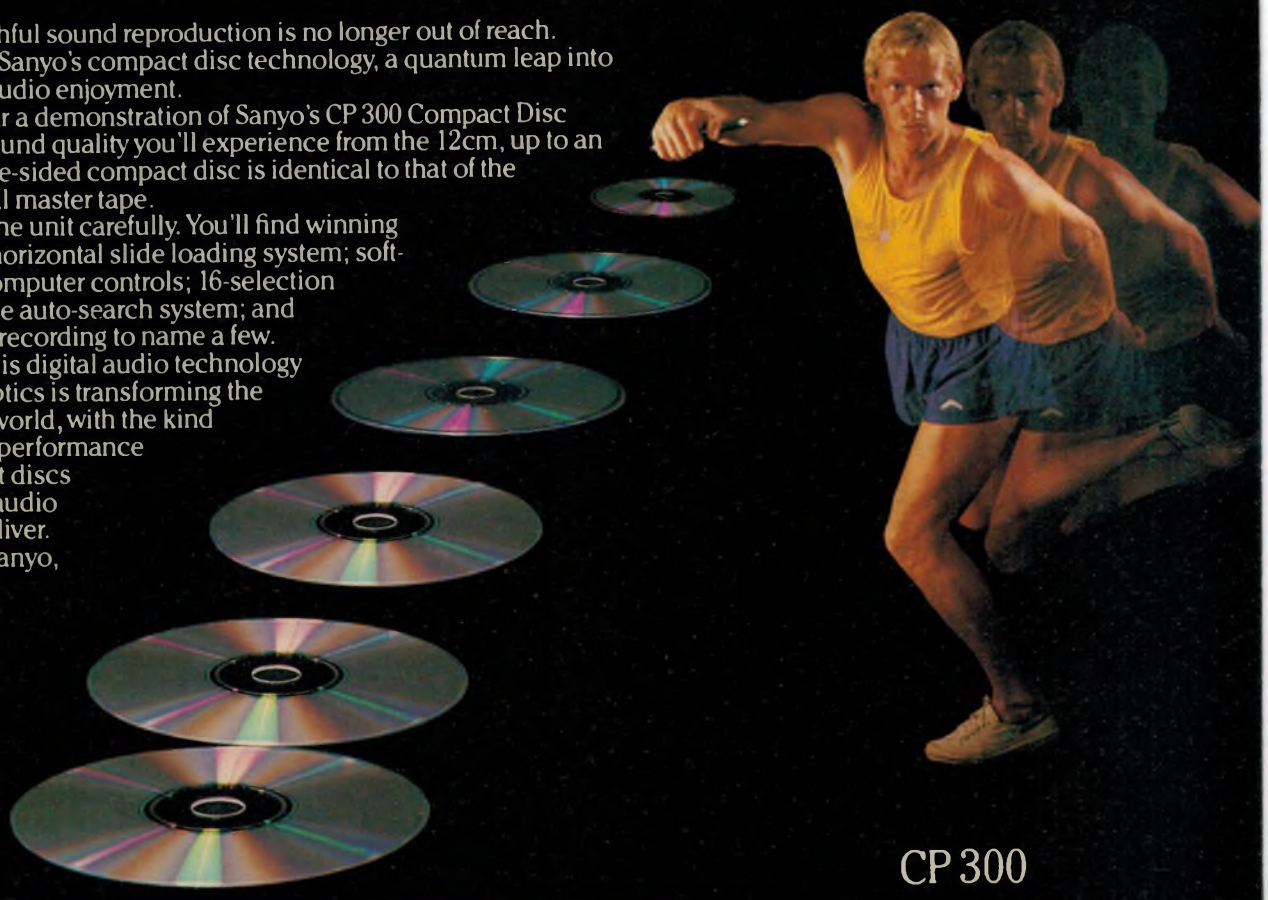

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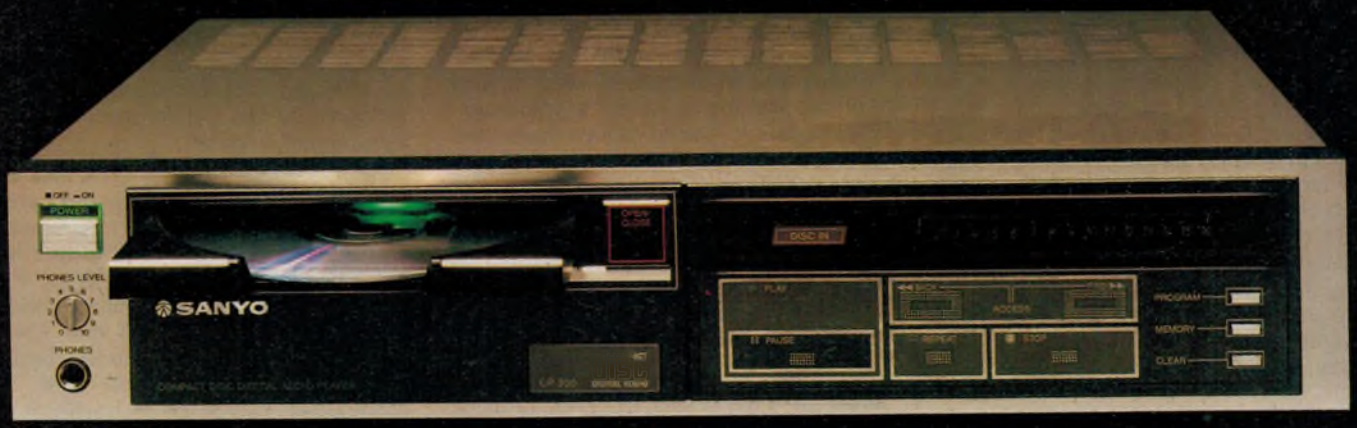

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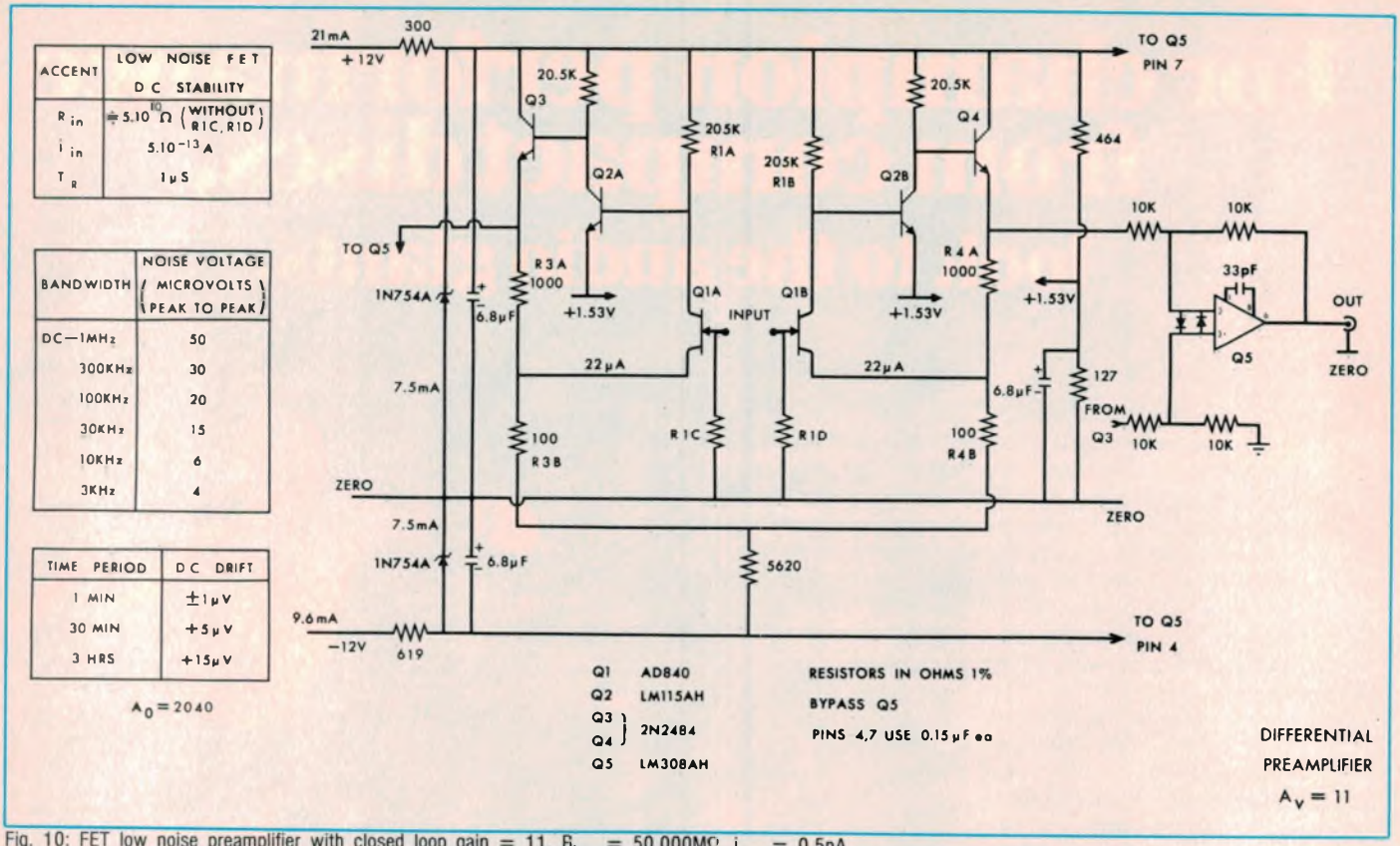

Fig. 10: FET low noise preamplifier with closed loop gain = 11. R_{in} = 50,000MΩ, i_{in} = 0.5pA.

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harmonics picked up from 50Hz TV vertical deflection circuits; and bursts of noise from switch openings and closings.

The cure for these noise effects is obvious: better power supply design, decoupling, shielding and separation. Attempts to remove 50Hz interference by means of notch filters often fail as the radiated interference also contains a collection of higher harmonics.

Under some conditions much of the received hum, especially the 50Hz component, can be removed by the use of differential amplifiers having high common mode rejection. This is a subject which we will treat in a future part of this series. For the moment, we observe that all our integrated circuits are actually differential amplifiers, but we commonly implement them into single sided (non-differential) closed loop amplifiers.

The low noise design

From the foregoing, we see that our low noise amplifier should be designed along the following lines:

- All efforts should be concentrated on the first stage which will have a closed loop gain of about 100. After such gain, noise will not be a problem in most applications.
- The front end should be a feedback amplifier for linearity, but should only have moderate open loop gain so that the infamous "voltage at x" will not be too small.
- We construct our own amplifier for the first stage rather than use an integrated circuit.
- The front end should use bipolar junction transistors having wide bandwidth, high h_{FE} and the lowest possible noise figure; wire wound or metal film resistors; decoupled power supplies; and no coupling capacitors.
- As every junction contributes noise, the number of transistors used before gain should be kept to a minimum. Therefore we forbid active load and active tail circuits, super beta transistors and Darlington pairs.
- Tests should establish the optimum collector current.
- The input impedance should be adequate for normal requirements.

Suitable transistors

From data books, we observe that, for single NPN transistors, the 2N3117 has a very small noise figure (1dB under some conditions), with the 2N2484 and SE4010 running a close second. Amongst the dual NPN transistors, the LM114AH, LM115AH, 2N2920, LM194 and LM394 are some of the quietest. Tests were conducted to establish the collector current range for the lowest noise. The results, plotted in Fig. 5, show a low noise plateau in the curve for collector currents in the range 3 to 30 microamps. Other characteristics are also satisfactory in this range. For example, the LM114AH has h_{FE} = 500 minimum and f_T = 22MHz at 10 microamps.

A practical low-noise amplifier design is shown in Fig. 6 and uses LM115AH transistor input stages operating at 23 microamps collector current. The circuit can be broken down into two sections, the first consisting of a six transistor differential negative feedback amplifier (Q1A, Q1B, Q2A, Q2B, Q3 and Q4) with an open loop gain of 9000, a closed gain of 101 and differential output. This is followed by Q5, a differential unity gain operational amplifier.

Input is applied to the Q1A and Q1B bases, the input impedance and current being 8.2MΩ and 20 nanoamps respectively. Q1A and Q1B form a long tail pair with R5 the tail resistor. R3A, R3B, R4A and R4B form voltage dividers from the emitters of Q3 and Q4 to provide differential negative feedback to the emitters of Q1A and Q1B. The closed loop gain of the six transistor first stage is equal to 1 + (R3A/R3B) = 101. This emitter feedback raises the input impedance at the bases of Q1A and Q1B and widens the bandwidth of the six transistor stage to 500kHz, which can be reduced if you like by the addition of

optional C1.

Q5 resolves the differential outputs from Q3 and Q4 into a single output. Because the signal is raised by a factor of 101 before being presented to Q5, the noise of this operational amplifier is much smaller by comparison, and hence unnoticeable.

The preamplifier responds linearly to input signals up to 43 millivolts, and has excellent DC stability and low drift. The latter is a result of a symmetrical circuit arrangement, dual transistors Q1 and Q2, small transistor heating (23 microamps collector current) and the use of 1% metal film resistors throughout. The back-to-back diodes across the input to Q5 prevent heating of the latter's input transistors in case of accidental signal imbalance, such as occurs in overdrive or power switch-on surges.

Stray capacitance

To ensure small stray capacitances, the amplifier should be constructed on a small PC board as shown in Fig. 7. If a plug and socket are used, gold contact surfaces are absolutely essential.

There is, of course, no reason why the operational amplifier stage Q5 could not have gain higher than unity. This would simply involve changing R11 and R13 from 10kΩ to some higher value, with a corresponding reduction in the 33pF compensation capacitor on pins 1 and 8. This increase in gain should not be taken too far, otherwise instability may result. If your application demands a circuit suitable for higher input voltages, a change may be made in the feedback ratio R3A/R3B, R4A/R4B. For example 7870 ohms/787 ohms will result in a first stage closed loop gain of 11, as in Fig. 9, with the ability to respond linearly to inputs up to 400 millivolts.

Measured noise in both cases is 700 nanovolts RMS, ie 4 microvolts peak to peak, from DC to 10kHz, referred to the input. If the 8MΩ imput impedance is not high enough or the 20 nanoamp input current is not low enough for some applications, two courses of action may be taken. First, Q1's collector current may be reduced to 4 microamps by raising R1A and R1B to 1MΩ. If R1C and R1D are now removed, the preamplifier will have an input impedance of 100MΩ and an input current of 4.0 nanoamps, with no noticeable change in noise.

The alternative is to substitute a low noise dual field effect transistor for Q1 with minor circuit changes as in Fig. 10. The dual FET type AD840 was chosen for this role. With R1C and R1D removed, the imput impedance measured 50,000MΩ with an input current of 0.5 picoamps. Noise is about double the previous example, or 1.2 microvolts RMS (6.0 microvolts peak to peak), from DC to 10kHz.

The dual transistors and FETs specified are excellent units and well worth their higher price. But your poor impoverished author thought he would define a new unit to be called the "noise microvolt-dollar product", which should be kept to a minimum. Accordingly, the circuit Fig. 6 was rebuilt using six SE4010 transistors, while R1C and R1D were changed to 1MΩ. All other components remained the same, except that no plug-socket was used.

The result was a preamplifier of much lower cost, but with noise almost the same: 700 nanovolts RMS or 4 microvolts peak to peak (referred to input) from DC to 10kHz. Input impedance with R1C and R1D measured approximately 1MΩ and the input current 0.1 microamps. Because the transistors are not pairs, DC drift was much higher but this was reduced by sliding tygon tubing over pairs of transistors and pumping the tubing full of Dow-Corning DC4 silicone grease for thermal coupling. Readers who are still awake will find a summary of these preamplifier variations in Table 2.

Next month, we will consider the implications of DC coupling, high gain and drift.

PREAMPLIFIER	Fig.	NOISE (0-10kHz) P-P µV	NOISE (0-10kHz) RMS µV	* Rin Ω	Iin A	Cin pF	† BANDWIDTH Hz	† OPEN LOOP GAIN Ao	CLOSED LOOP GAIN Av	Vin MAX ±mV	Vout MAX ±V	DRIFT RATE µV/hr
BASIC Q1 = 2N2920 (Ic = 4µA, R1A,B = 1M)	9	4	0.7	10^9	4.10^{-14}	20	100000	6000	11	300	3.3	20
BASIC Q1 = 2x2N3117	6	3.8	0.7	8.10^7	2.10^{-11}	20	500000	9000	100	38	3.8	300
BASIC Q1 = 2xSE4010	6	4	0.7	10^9	10^{-11}	20	300000	4000	100	38	3.8	90
BASIC Q1 = 2N2920, LM114AH	6	4	0.7	8.10^7	2.10^{-11}	20	500000	9000	100	38	3.8	6
FET Q1 = AD840	10	6	1.2	5.10^{14}	5.10^{-13}	20	500000	2040	11	120	1.32	6
FET Q1 = AD840 (16V VERSION)	10	6	1.2	5.10^{14}	4.10^{-13}	20	500000	4000	10.1	500	5	6

TABLE 2

* R1C,R1D DELETED

† SIX TRANSISTOR SECTION, FROM LOW IMPEDANCE

Table 2: summary of preamplifier performance variations for different transistors.

Will your

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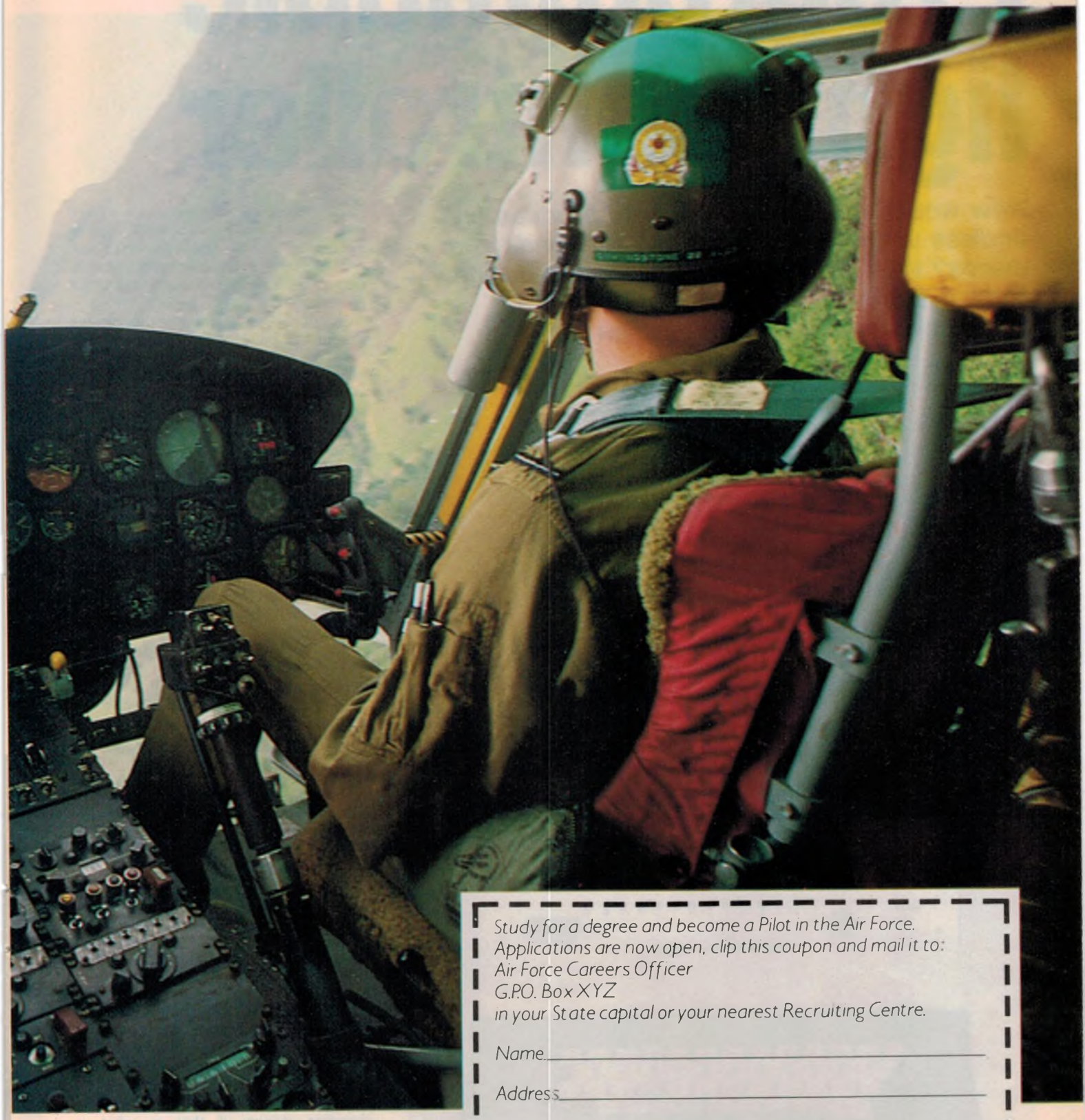

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enough?

Programmable light controller

How would you like to be able to produce an endless variety of light patterns for bands and discos? With a personal computer and our new lighting controller you can do just that.

by PETER VERNON and COLIN DAWSON

These days it is "de rigeur" for a band or disco to have a complex lighting system. Lights include strobes, mirrorballs, multi-coloured panels, ribbon lights and moving displays which are usually driven by chasers.

Chasers are okay as far as they go but the limited patterns they produce soon become boring. What you want is a programmable light controller which can vary the patterns of lights it is driving. But such controllers are quite expensive and probably out of the reach of all but the most well-heeled band.

An alternative approach is to produce a very simple light controller which can drive quite a few channels but is controlled by a personal computer. This is what we have done. Our light controller will drive up to 14 channels, any of which may consist of up to 1000 watts of incandescent lamps. Naturally the total lamp load which can be driven by the unit is limited by normal mains GPOs (general purpose outlets) to 2400W but we will talk more about that later.

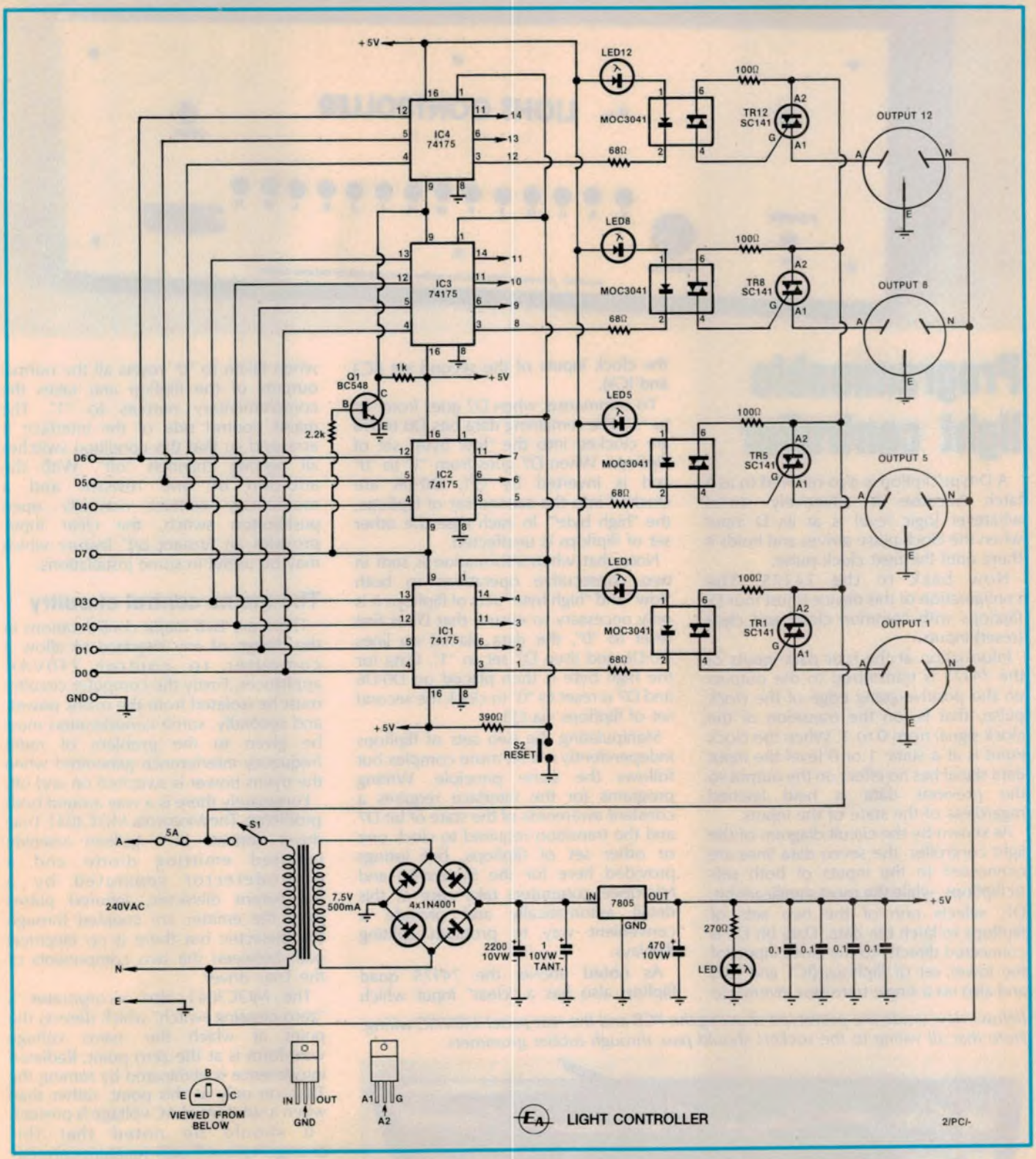
To use this light controller with any computer requires just one 8-bit parallel output port. There are no address lines to be decoded, special purpose strobe signals or other control lines. The Centronics printer port of an office computer can be used, or the outputs of a PIA (Peripheral Interface Adapter) on computers such as the single-board DATUM project.

Interfacing to the computer requires no special measures and the mains circuitry of the light controller is completely isolated from the computer's output port. The lights are controlled by Triacs which are triggered by zero-voltage switching devices which assures that the lighting circuitry produces negligible electromagnetic interference (EMI).

Programming the computer and thus the light show is simplicity itself. It's all done in Baisc which is executed quickly enough to produce a very rapidly changing display if that is what is required.

How it works

Have a look at the circuit. There is

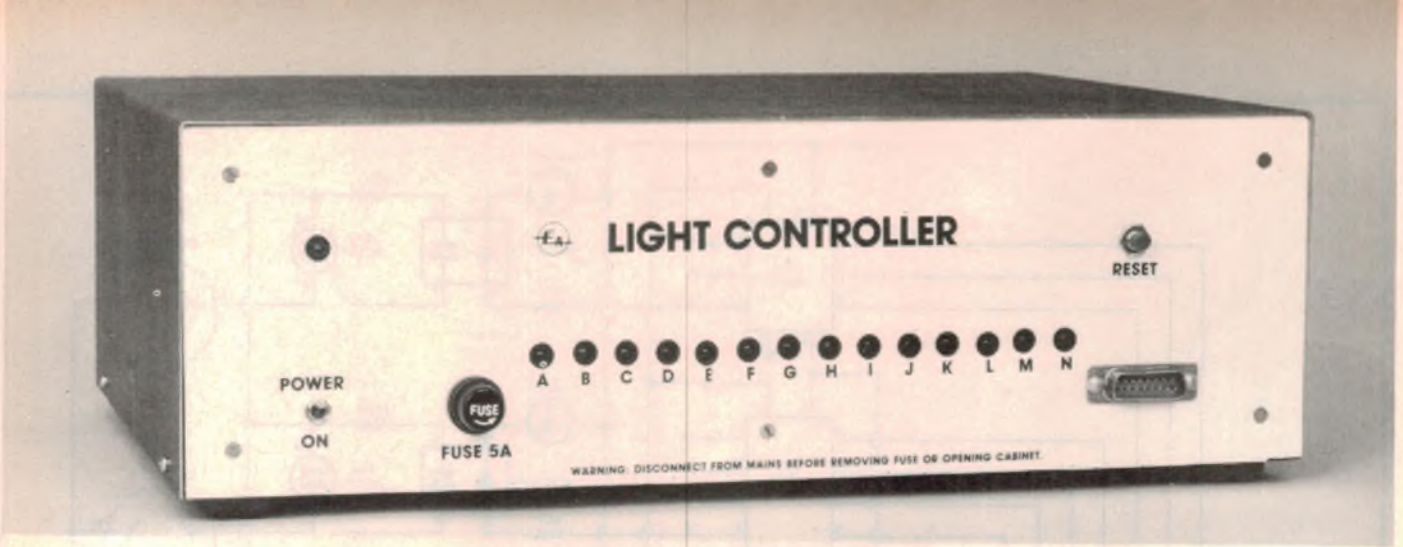


really not much too it. Just four ICs provide all the logic and are in fact the interface to the computer. Then there are the Triacs which can be any number up to 14. For each Triac there is an optocoupler trigger device. And that's it, apart from the power supply.

How do you control a maximum of 14-channels from an 8-bit output port without going to a system of encoding and decoding? Take our word for it, there is essentially no decoding.

Basically, seven of the data bits from the output port are connected in parallel to two sets of two 4-bit latches. The eighth data bit from the port selects one pair of latches as the ultimate destination for each 7-bit control byte. The first pair of latches thus controls the first seven lighting channels and the second pair controls the next seven channels.

The four logic ICs referred to earlier are each 74175s. These can be considered as four bit latches or as quad D-type flipflops. Perhaps the latter way is the easiest way of looking at it. For those who have forgotten, a D-type flipflop is one that feeds the data on its D-input (yep, D stands for data) through to its Q output when it gets a clock pulse.



Programmable light controller

A D-type flipflop is also referred to as a latch because it effectively stores whatever logic level is at its D input when the clock pulse arrives and holds it there until the next clock pulse.

Now back to the 74175. The configuration of this device is just four D-flipflops with common clock and clear (reset) inputs.

Information at the four data inputs of the 74175 is transferred to the outputs on the positive-going edge of the clock pulse, that is, on the transition of the clock signal from 0 to 1. When the clock input is at a static 1 or 0 level the input data signal has no effect on the output so the previous data is held latched regardless of the state of the inputs.

As shown by the circuit diagram of the light controller, the seven data lines are connected to the inputs of both sets of flipflops, while the most significant bit, D7, selects one of the two sets of flipflops to latch the data. Data bit D7 is connected directly to the clock inputs of the lower set of flipflops (IC1 and IC2) and also via a single transistor inverter to the clock inputs of the second set (IC3 and IC4).

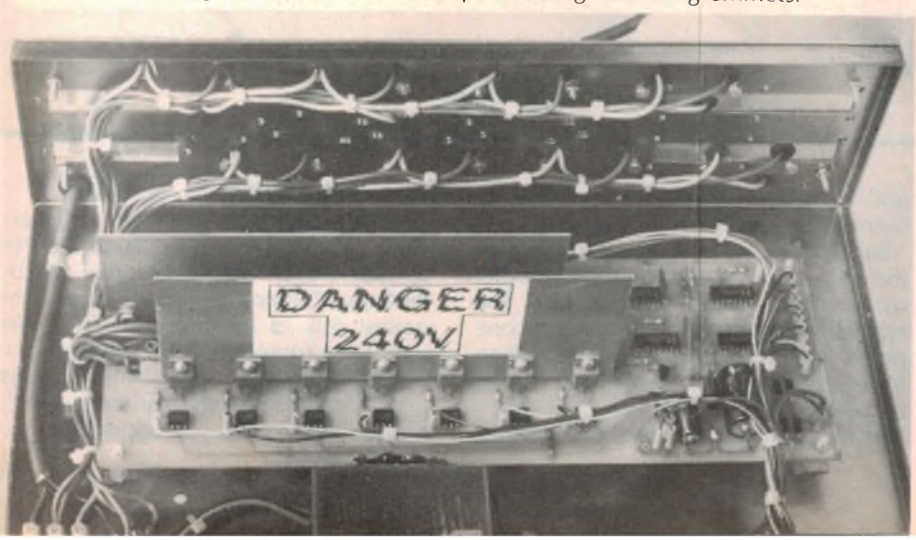
To summarise, when D7 goes from "0" to "1", the remaining data bits D0 to D6 are clocked into the "low byte" set of flipflops. When D7 goes from "1" to "0" and is inverted by Q1, D0-D6 are clocked into the second set of flipflops, the "high byte". In each case the other set of flipflops is unaffected.

Note that when information is sent in two consecutive operations to both "low" and "high byte" sets of flipflops it is only necessary to ensure that D7 is first reset to "0", the data placed on lines D0-D6 and then D7 set to "1". Data for the high byte is then placed on D0-D6 and D7 is reset to "0" to clock the second set of flipflops via Q1.

Manipulating the two sets of flipflops independently is a bit more complex but follows the same principle. Writing programs for the interface requires a constant awareness of the state of bit D7 and the transition required to clock one or other set of flipflops, but listings provided here for the System-80 and MicroBee computers take care of this detail automatically and provide a convenient way to program lighting displays.

As noted above, the 74175 quad flipflop also has a "clear" input which when taken to "0" resets all the normal outputs of the flipflop and takes the complementary outputs to "1". The mains control side of the interface is arranged so that this condition switches all lighting channels "off". With the addition of one resistor and a momentary contact normally open pushbutton switch, the clear input provides an "instant off" feature which may be useful in some installations.

Below: view inside the prototype showing the PCB and the rear panel 240VAC wiring. Note that all wiring to the sockets should pass through rubber grommets.



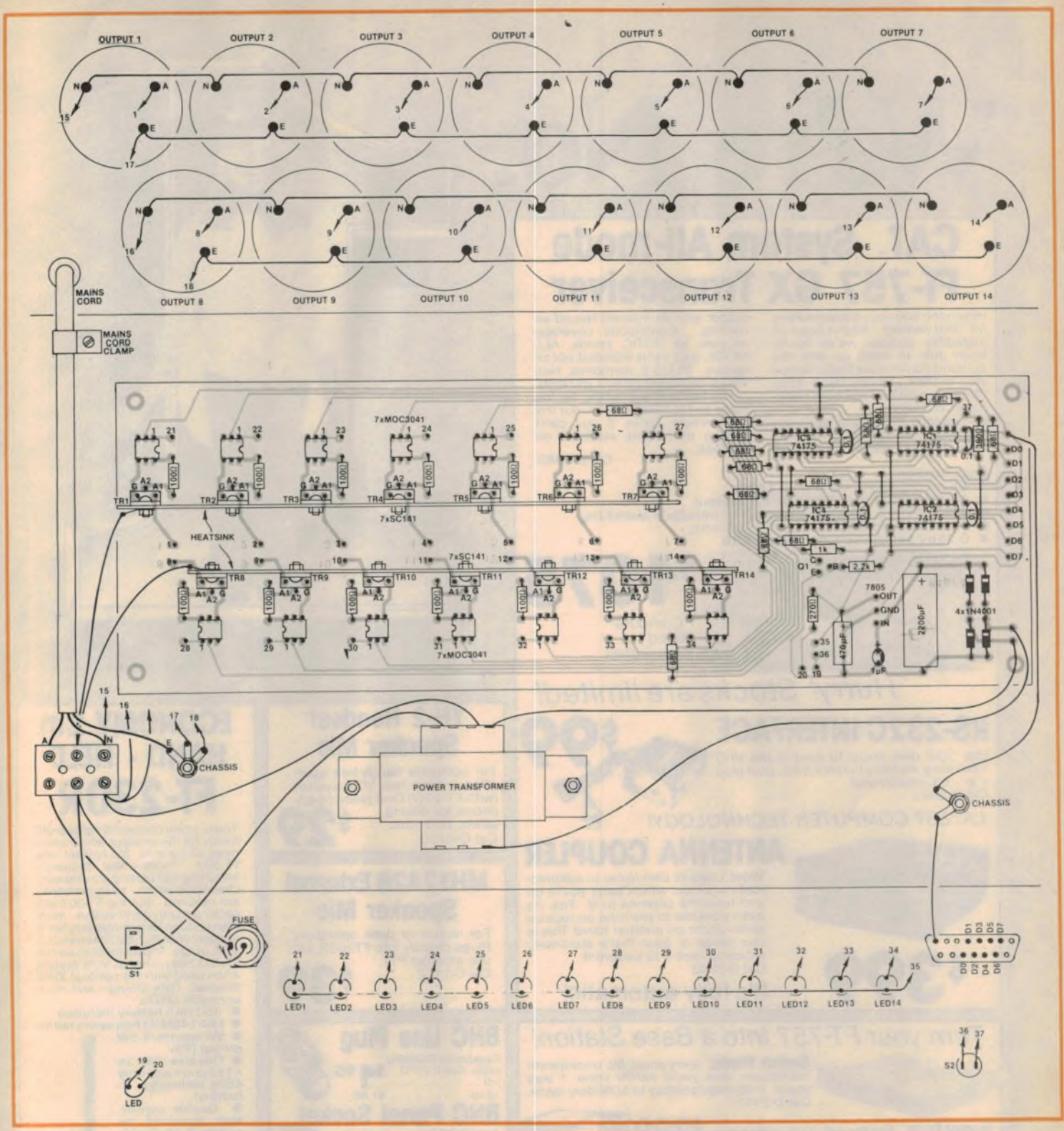
The mains control circuitry

There are two major considerations in the design of any interface to allow a computer to control 240VAC appliances. Firstly the computer circuitry must be isolated from the mains power, and secondly, some consideration must be given to the problem of radio frequency interference generated when the mains power is switched on and off.

Fortunately there is a way around both problems. The Motorola MOC3041 Triac driver consists of a gallium arsenide infrared emitting diode and a photodetector separated by a transparent dielectric. Infrared pulses from the emitter are coupled through the dielectric but there is no electrical path between the two components of the Triac driver.

The MOC3041 also incorporates a "zero crossing switch" which detects the point at which the mains voltage waveform is at the zero point. Radiated interference is eliminated by turning the Triac on only at this point, rather than when a substantial AC voltage is present.

It should be noted that this arrangement will only function correctly when the Triacs are switching loads that are substantially resistive – such as incandescent lamps. The zero crossing feature is such that the voltage and current waveform through the detector must be in phase. Reactive loads (such as motors) change this phase relationship and interfere with the operation of the Triac drivers. This also prohibits the use of fluorescent lights as the ballast will introduce a phase difference.



The optically coupled Triac drivers are controlled by the Q outputs of the flipflops, which always present an inverted version of the data latched into the flipflops from the inputs. LED indicators in series with each optocoupler provide a visual confirmation of the state of each flipflop output and allow control programs to be developed without necessarily connecting the mains powered lights.

By using the complementary outputs to invert the data inputs we ensure that the Triacs will light the lamps when a "1" is sent to the appropriate input, reducing the chance of confusion when it comes to programming the controller.

The Triacs specified for the Light Controller are SC141D types which can handle an incandescent lamp load of up to 1000 watts. (Note that the individual lamps should not be rated above 100W otherwise a lamp failure may also take the Triac with it.) Clearly, the total load which could be connected to the Controller would be less than 14 x 1000W unless the system was carefully programmed to limit the total power consumption to 2400W or less, at all times.

As a practical example, if you decided to have a maximum of eight channels (out of a possible 14) then each channel

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GaAs FET receiver preamp, operates over full 430-440MHz band with 0.15uV sensitivity (SSB, 12dB SINAD).
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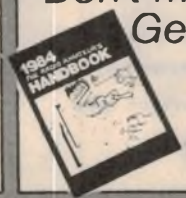

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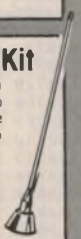

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See page 98 for full address details.

A740/LL

MicroBee Control Program

```
00100 REM Light controller program for the MicroBee
00110 REM
00120 DIM Z(100,2)
00130 CLS
00140 PRINT"Do you want to: 1) Define a pattern"
00150 PRINT"                2) Save a pattern to tape"
00160 PRINT"                3) Load pattern from tape"
00170 PRINT"                4) Run a pattern"
00180 PRINT"                5) Turn all channels off"
00190 PRINT
00200 INPUT "Your selection";A
00210 ON A GOSUB 230,660,830,520,1000
00220 GOTO 130
00230 N=0
00240 L1=0:H1=0:E=0
00250 CLS
00260 PRINT"Program step";N
00270 PRINT"Type 'STOP' to quit this part. Do not use"
00280 INPUT"commas in input. Which channels on (A-N)";A1$
00290 IF A1$="STOP" OR A1$="stop" THEN RETURN
00300 INPUT "For how long (in seconds)";S
00310 REM translate entries to codes for output
00320 FOR B=1 TO LEN(A1$)
00330 B1$=A1$(;B,B)
00340 IF B1$=" " THEN GOTO 420
00350  C=ASC(B1$)-65
00360 C1=FLT(C)
00370 IF C1>13 THEN LET C1=C1-32:REM Allow for lowercase inputs
00380 IF C1<0 OR C1>13 THEN LET E=1
00390 IF C1=>7 THEN GOTO 410
00400 L1=L1+2^C1:GOTO 420
00410 H1=H1+2^(C1-7)
00420 NEXT B
00430 IF E=1 THEN PRINT "Error - invalid input ignored"
00440 IF E=1 THEN FOR D=1 TO 1000:NEXT D:GOTO 240
00450 REM store output codes and times in array Z()
00460 Z(N,0)=INT(L1+.1)
00470 Z(N,1)=INT(H1+.1)
00480 Z(N,2)=S
00490 N=N+1
00500 GOTO 240
00510 REM ******************************************************
00520 REM **** Read codes from array and turn on channels ****
00530 OUT#1 ON:REM Set parallel port for output
00540 FOR I=0 TO N
00550 L=Z(I,0):H=Z(I,1):S=Z(I,2)
00560 OUT 0,L:OUT 0,L+128
00570 OUT 0,H+128:OUT 0,H
00580 REM Delay for S seconds
00590 REM 800 is approximate factor for one second loop
00600 FOR D=0 TO 800*S:NEXT D
00610 NEXT I
00620 IF KEY$="" THEN GOTO 520:REM Loop unless key pressed
00630 OUT#0:REM Disable parallel port output
00640 RETURN:REM If a key is pressed
00650 REM ***********************************************
00660 REM****** Write array contents to tape ********
00670 INPUT "What is the name of this pattern data";B1$
00680 PRINT "Press PLAY and RECORD on cassette recorder"
00690 INPUT "Press RETURN when ready";V1$
00700 OUT#3:REM select 1200 baud cassette output only
00710 FOR I=1 TO 3:PRINT"!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!":NEXT I
00720 REM "!" is dummy data
00730 PRINT"$$$$$$$$$$";B1$:REM Write header and name
00740 PRINT N:REM Write number of steps in this pattern
00750 FOR I=0 TO N
00760 PRINT Z(I,0)
00770 PRINT Z(I,1)
00780 PRINT Z(I,2)
00790 NEXT I
00800 OUT#0:REM Restore video output
00810 RETURN
00820 REM ******************************************
00830 REM****** Read pattern data from tape *********
00840 INPUT "What is the name of the pattern required";T3$
00850 PRINT"Press PLAY on cassette recorder"
00860 INPUT "Press RETURN when ready";V1$
00870 IN#3:OUT#0:OUT#0 OFF:REM 1200 baud input, no output
00880 INPUT T1$
00890 IF T1$(;1,10)<>"$$$$$$$$$$" THEN GOTO 880:REM wait for head
00900 T2$=T1$(;11):REM get file name
00910 IF T2$<>T3$ THEN GOTO 880:REM Wait for correct name
00920 INPUT N:REM get number of steps
00930 FOR K=0 TO N
00940 PRINT K
00950 INPUT Z(K,0),Z(K,1),Z(K,2)
00960 NEXT K
00970 IN#0:OUT#0:REM Restore Kbd input, video output
00980 RETURN
00990 ***********************************************
01000 REM********** Turn all channels off **********
01010 OUT#1:REM Enable parallel port for output
01020 OUT 0,0:OUT 0,128:OUT 0,0
01030 OUT#0:REM Restore video output
01040 RETURN
```

This control program lets you define light patterns up to 100 steps long on the MicroBee personal computer.

Programmable light controller

might be set to control 200W – say 10 x 20W bulbs. This would give a total of 80 lamps.

The exact capacity of the controller depends on the details of construction however. Our prototype used mains wiring rated at 7.5A and a 5A mains fuse with eight channels operating. Using cable and a fuse of a higher rating will allow some increase in the capacity of each channel or the use of more channels.

The software

In spite of the use of the eighth bit to select one or other pair of flipflops, software for the interface is relatively simple. To send a byte to the lower seven channels, set up the pattern required in bits D0 to D6 (a "1" for that channel on, "0" for channel off), with bit D7 equal to "0".

Send this byte to the output port, using either the OUT or POKE statement, depending on your Basic interpreter. The next step is to add 128 to this value and send the result to the output port, producing the transisiton which latches the lower seven bits into the flipflops controlling the lower seven channels of the lighting pattern.

To control the upper seven channels, calculate the lower seven bits of the control byte in the same way and add 128 to take bit D7 to "1". Send this byte to the output port, then subtract 128 and send the result to the port, producing a transition of D7 from "1" to "0". When inverted by the interface this transition will latch the control byte into the flipflops controlling the upper seven channels.

Lines 450 to 480 of the System-80 program (Listing 1) show what is required. Here the OUT statement is used, and the data sent to the parallel printer port of the System-80 expansion interface (I/O location 253).

The remainder of listing 1 simply adds convenience features, allowing a sequence of control bytes to be created and sent at a pre-determined rate to the light controller interface. Sequences of instructions can also be saved to disk for later use or recalled and sent to the light controller.

We have used letters to indicate each lighting channel (from A to N). When running the System-80 program, defining a new patern is simply a matter of typing a string of letters, one for each channel which will be turned on, and a time factor which determines how long this particular program step will last.

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74S30	.72	.58
74S32	.74	.60
74S51	.68	.54
74S74	1.07	.85
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74S86	.96	.88

TOO MANY TO LIST

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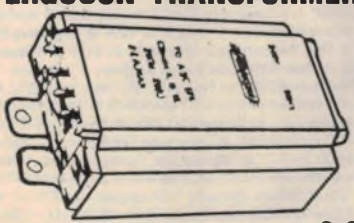

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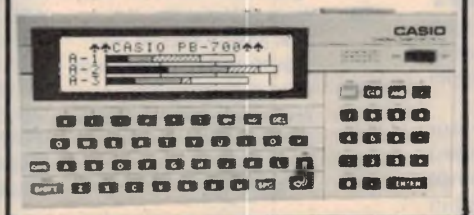

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DICK SMITH ELECTRONICS

DSE A751/KT

Programmable light controller

The time factor need not be a integer – inputs of 0.1 second are quite acceptable, although shorter times may not give satisfactory results as the light bulbs take a finite amount of time to reach full brightness after switch on. Fast moving patterns will need to take this into account.

Timing is not precise, being based on a simple FOR ... NEXT loop and a multiplier factor established experimentally.

The time in seconds is multiplied by a number which produces a one second delay loop on the particular computer in use. For the System-80 this value is about 260, but it will require adjustment if the program is used with other computer systems. The delay is produced by lines 490 to 510 of listing 1.

Light control sequences with up to 100 steps can be produced using this program. The total is set by the DIM statement in line 40 and can be changed depending on what is required. At the moment the program is set up so that the pattern repeats continually until a keyboard entry is made (see line 520).

The remainder of listing 1 generates a menu of options, converts channel designations to output codes to the interface and takes care of disk operations. Each subroutine is "stand alone" apart from the initialisation section (lines 30-40), so if you don't want to use disk storage, simply leave out these routines and change line 110 to reflect the new condition.

Listing 2 is for the MicroBee computer, although the string functions used also make it suitable for the Super-80 system. It includes a new subroutine, from line 1000 to line 1040, which simply turns all lighting channels off. A cassette recorder is used for mass storage of lighting sequence rather than disks.

The MicroBee has a feature called "I/O redirection" which requires that the parallel port first be defined as an output before it can be used. This is the purpose of the statement OUT 1 ON in line 530 of listing 2. The tape routines also require separate enabling and disabling statements for the cassette interface, as in lines 870 and 970.

For use with the Super-80 these particular statements can be omitted. Of course, the OUT statements must also be changed to direct output to the parallel printer port of the Super-80 printer interface add-on board, while the cassette routines for the MicroBee will not be appropriate and will need to be replaced by routines specific to the Super-80.

System-80 Control Program

```
10 REM LIGHT CONTROLLER PROGRAM FOR THE SYSTEM-80
20 REM REQUIRES OS-80 DISK OPERATING SYSTEM
30 DEFINT L,H,E,C
40 DIM CH(100,2)
50 CLS
60 PRINT"DO YOU WANT TO: 1) DEFINE A NEW PATTERN"
70 PRINT"                2) SAVE A PATTERN TO DISK"
80 PRINT"                3) LOAD PATTERN FROM DISK"
90 PRINT"                4) RUN A PATTERN"
100 INPUT"YOUR SELECTION";A
110 ON A GOSUB 130,600,800,400
120 GOTO 50
130 N=0
140 L=0:H=0:E=0
150 CLS
160 PRINT"PROGRAM STEP";N
170 PRINT"TYPE 'STOP' TO QUIT THIS PART. DO NOT USE COMMAS"
180 INPUT"IN INPUT. WHICH CHANNELS ON (A-N)";A$
190 IF A$="STOP" THEN GOTO 390
200 INPUT "FOR HOW LONG (IN SECONDS)";S
210 REM TRANSLATE CHANNEL ENTRIES TO CODES FOR OUTPUT
220 FOR B=1 TO LEN(A$)
230 B$=MID$(A$,B,1)
240 IF B$=" " THEN GOTO 300
250 C=ASC(B$)-65
260 IF C<0 OR C>13 THEN E=1
270 IF C=>7 THEN GOTO 290
280 L=L+2[C
290 H=H+2[(C-7)
300 NEXT B
310 IF E=1 THEN PRINT "ERROR - INVALID INPUT IGNORED"
320 IF E=1 THEN FOR D=1 TO 250:NEXT D:GOTO 140
330 REM STORE OUTPUT CODES AND TIMES IN ARRAY CH()
340 CH(N,0)=L
350 CH(N,1)=H
360 CH(N,2)=S
370 N=N+1
380 GOTO 140
390 RETURN
400 REM READ CODES FROM ARRAY AND TURN ON CHANNELS
410 FOR C=0 TO N
420 L=CH(C,0)
430 H=CH(C,1)
440 S=CH(C,2)
450 OUT 253,L
460 OUT 253,L+128
470 OUT 253,H+128
480 OUT 253,H
490 REM DELAY FOR 'S' SECONDS
500 FOR Z=0 TO 260*S:NEXT Z:REM 260 IS APPROXIMATE FACTOR
510 NEXT C
520 IF INKEY$="" THEN GOTO 400:REM REPEAT UNTIL KEY PRESSED
530 RETURN
600 REM SAVE ARRAY CONTENTS (UP TO 40 STEPS) ON DISK
610 FOR I=0 TO 40
620 DEF FIELD#1, I*6 AS X$,2 AS L$,2 AS H$,2 AS S$
630 L=CH(I,0):H=CH(I,1):S=CH(I,2)
640 LSET L$=MKI$(L)
650 LSET H$=MKI$(H)
660 LSET S$=MKI$(S)
670 NEXT I
680 DEF FIELD#1, 240 AS XX$,2 AS ST$
690 LSET ST$=MKI$(N)
700 INPUT "SECTOR NUMBER OF STORAGE AREA";DS
710 PUT#1,DS
720 PRINT "ARRAY STORED ON DISK SECTOR";DS
730 FOR D=1 TO 1000:NEXT D
740 RETURN
800 REM READ ARRAY CONTENTS FROM DISK
810 INPUT "SECTOR NUMBER OF STORAGE AREA";DS
820 GET#1,DS
830 FOR I=0 TO 40
840 DEF FIELD#1, I*6 AS X$,2 AS L$,2 AS H$,2 AS S$
850 CH(I,0)=CVI(L$)
860 CH(I,1)=CVI(H$)
870 CH(I,2)=CVI(S$)
880 NEXT I
890 DEF FIELD#1, 240 AS XX$,2 AS ST$
900 N=CVI(ST$)
910 RETURN
```

This control program is suitable for both System-80 and TRS-80 Model 1 computers. Unlike the MicroBee program, it stores the pattern on disk rather than on tape.

Construction

A sturdy metal box, and quite a large one at that, is the first requisite for construction. We chose a Playmaster Mosfet amplifier box. This is particularly rugged and large enough to fit eight normal surface mounting sockets on the back panel. With the smaller surface mounting sockets, made by Clipsal, it should be possible to fit the full 14 on the Playmaster box.

If you do select the Playmaster box, a fair amount of "tin-bashing" awaits you. For starters, new front and rear panels will need to be manufactured. The

Programmable light controller

Playmaster boxes are made overseas, complete with front and rear panel cut outs which don't suit the Light Controller.

While you've got the metal working tools out, make a pair of heatsinks. Two strips of aluminium will be adequate. The area is not critical, but they should be about 190mm long. The Triac mounting holes have to be spaced at 28mm intervals.

We have mounted everything except the output sockets on the front panel of the box. This includes the fuse holder and the data input connector, which are more accessible "up-front". Note that a LED should be mounted on the front panel for each of the output channels, ie if the full 14 outputs are used then 14 indicator LEDs should be used. This will provide verification that a given channel is working, even where the light bulb is blown.

We have also included a reset button and a power indication LED, but both of these items are optional.

When the metalwork is complete, turn your attention to the printed circuit board. The PCB, coded 83pc4, is quite large at 302 x 102mm to allow adequate spacing between the 5V and 240V sections. Begin by inserting the PCB pins (these are for the low voltage connections only). PCB mounting terminal blocks are used for the 240V connections to the board – there are 7 two-way terminals in all.

Insert the ten links before the remaining components. Finish off with the Triacs and be certain to set them all at the same height. This will make it a simple matter to fit the heatsinks when the time comes.

The choice of transformer is not critical – we used a 1A multi-tap 6672. The 7.5V tap is ideal for the project. Actually any transformer with a secondary voltage of between 7.5V and 15V at 500mA can be used. Mount it so that the primary connections are well clear of the PCB. Make sure that the voltage rating of the 2200μF filter capacitor exceeds the rectified voltage of the transformer. With a 7.5V secondary, a 16V rating must be used.

Wiring is with 10-way rainbow cable for the low voltage circuits, and three-core mains flex for the 240V circuits. (Lengths in the parts list are for the eight channel version only). One metre of three-core flex is used for the power cord, and the remainder for the 240V internal wiring.

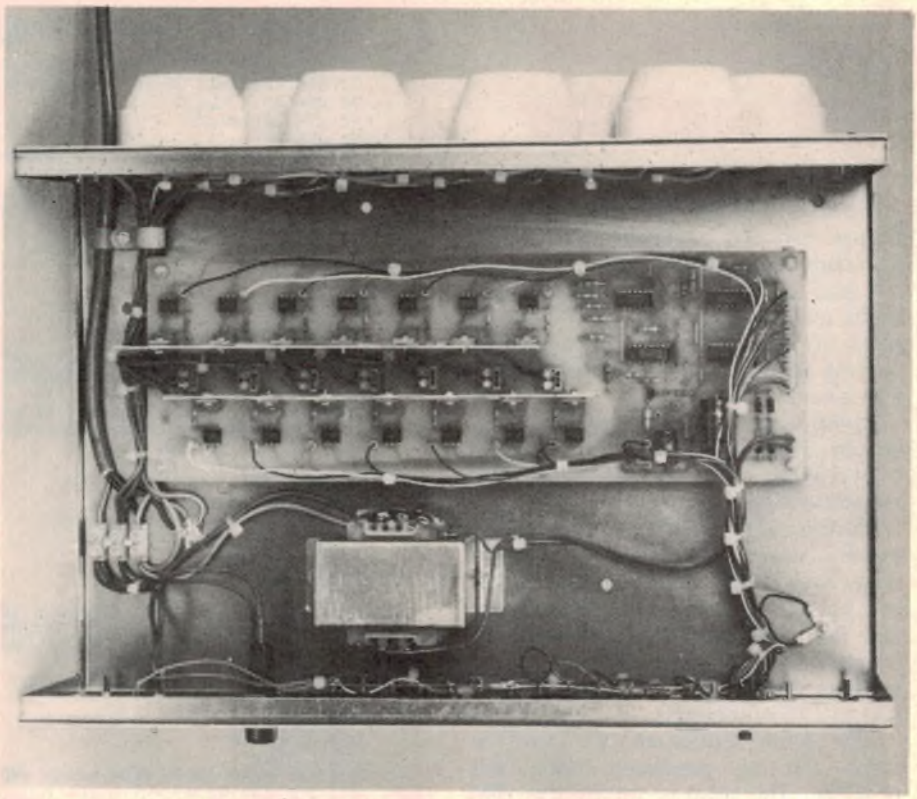
One metre of the rainbow cable is used for the data input cable. The remainder is stripped down to individual strands and used for the low voltage internal wiring. These should be bound together with small cable ties and the resulting cables so dressed that they cannot make contact with the heatsinks in any circumstances.

Use spaghetti or heatshrink tubing to cover the PCB pins when they have been terminated. Since the heatsinks cannot feasibly be insulated, the best alternative is to avoid exposed low voltage points.

Wherever mains wiring passes through a hole in the metal chassis, the hole should be grommeted. Remember that two wires will have to pass through many of the grommets.

When the wiring is complete, the heatsinks can be fitted. Since these heatsinks connect the Triac A2 terminals to the mains active, they are "live" whenever the Light Controller is plugged in. Obviously a shock hazard exists for anyone not mindful of this situation, so we have included a "WARNING 240V" sign. A copy of this should be applied to the outside of each heatsink.

Note that the mains power to the Triacs (and therefore the heatsinks) is not



The prototype was built into a Playmaster Mosfet amplifier chassis. Bind the low voltage leads together so that they cannot touch the heatsink.

Photostat two copies of this warning label and attach them to the outside surface of each heatsink. Note that the heatsinks are "live" whenever the Light Controller is plugged in.

We estimate the current cost of parts for this project to be

$180

This includes sales tax.

controlled by S1 – the power switch. Power is available to this part of the circuit as soon as the mains cord is plugged in. This presents no hazard with respect to load devices – they cannot be energised unless the Light Controller is switched on. However, it could be a trap for anyone attempting to troubleshoot the project. **Any mains powered circuit should be unplugged before being worked on, but this is doubly so with the Light Controller.**

A word of warning with respect to the fuse rating may be in order at this stage. The rating of the fuse should be determined by the mains hookup wire used. This is normally 7.5A, necessitating the use of a 5A fuse. Where 10A hook up wire is used, the fuse rating may be increased to 8A. Since power to the fuse is not controlled by the power switch, the Controller must be disconnected from the mains before a fuse change is contemplated.

With a 5A fuse, the maximum instantaneous load for the Light Controller would be 1200W.

Testing

Before using the Light Controller it is advisable to test it using a low AC voltage and suitable low voltage lamps. The only changes which need to be made are to the active connection to the heatsinks and the neutral connection to the output sockets.

With the unit disconnected from the mains remove the heatsink and socket AC connections from the mains terminal block and temporarily connect them to the secondary of the transformer. For a multi-tap transformer choose any convenient voltage, such as 12VAC. Once this connection is made the light controller can be used normally but the lower AC voltage will be switched through to the output sockets. An array of suitable miniature lamps can then be used to verify operation.

Initially, at least, test the device without connecting it to a computer. A few lamps may illuminate at switch on, but they should extinguish when the Reset button is pressed (where fitted). With a computer connected, you should be able to control the lamps using either of the programs provided here or software of your own devising.

This procedure is not only useful for initial testing but can also be used for toubleshooting if the need arises.

Following this low voltage test procedure, restore the circuit to normal (240VAC) operation by disconnecting the heatsink and socket power leads from the transformer secondary and re-connecting them to the mains terminal block (the active lead is the one connected to the heatsinks, the neutral to the sockets).

PARTS LIST

1 PCB, code 84pc4, 302 x 102mm
1 metal case to suit
1 Scotchcal front panel label
1 mains transformer, secondary 7.5V at 500mA
14 3-pin mains sockets (see text)
1 data bus plug and socket connector (9-pin D-type)
2 pieces 18g aluminium, 190 × 65mm
7 2-way PCB-mounting terminal blocks
1 3-way mains terminal block
1 SPST mains switch
1 SPST momentary contact switch
4 PCB stand-offs
42 small rubber grommets
36 small cable ties
1 mains cord grommet
4 cable clamps (1 large, 3 small)
1 3m mains cord and plug
29 PCB pins
5 solder lugs
15 LED bezels
1 240V fuse holder
1 fuse (see text)
2 "DANGER 240V" labels

SEMICONDUCTORS

4 74175 Quad D-type flipflops
1 BC548 NPN transistor
4 1N4001 diodes
1 7805 3-terminal regulator
14 MOC3041 Triac drivers
14 SC141D Triacs
15 LEDs

CAPACITORS

1 2200μF/16V electrolytic (see text)
1 470μF/10V electrolytic
1 1μF/10V tantalum
4 0.1μF ceramics

RESISTORS (¼W, 5%)

1 x 2.2kΩ, 1 x 1kΩ, 1 x 390Ω, 1 x 270Ω, 14 x 100Ω, 14 x 68Ω.

MISCELLANEOUS

Machine screws and nuts, rainbow cable (two metres), spaghetti insulation, heatshrink tubing, etc.

Without connecting the controller to a computer or any load devices, switch on. Any problems will most likely show up as a blown fuse. Disconnect the unit from the mains before attempting trouble-shooting. If all is well connect some 240V lamps to the output sockets and switch on again. With satisfactory results at this stage you are ready to connect the controller to a computer and try the programs provided.

Footnote: Since completion of this project, it has come to our attention that the MOC3041 Triac driver IC is in short supply. The MOC3040 can be substituted and will be satisfactory in almost all cases. However, it is possible that some will not work properly due to insufficient drive from the 74175 ICs.

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FUSE HOLDER M205

20 x 5mm Fuse

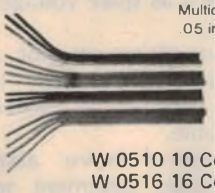
S5990..... **90c**
10 UP..... **80c** each

DIRECT IMPORT PRICE
CANNON TYPE CONNECTORS

		ea.	10 +
P 0960	3 Pin Line Male	4.50	3.95
P 0962	3 Pin Chassis Male	3.50	3.00
P 0964	3 Pin Line Female	4.50	4.00
P 0966	3 Pin Chassis Female	4.95	4.50

CHECK OUR PRICE ON
RAINBOW CABLE

Multicoloured Flat Ribbon Cable
.05 inch/1.27mm centres



	Price Per M ea.	Price Per M 10 +
W 0510 10 Core	1.10	.95
W 0516 16 Core	1.75	1.60
W 0524 24 Core	2.50	2.25

DE-SOLDER BRAID

HALF PRICE

T1230 ..... **$1**

CHECK THIS!

WATERCLEAR LEDS
(ILLUMINATE RED)
HIGH INTENTISY

Z0157 ..... 1 - 9 ..... **10c**
10 - 99 ..... **9c** 100 + ... **8c**

PROFESSIONAL AUTOMATIC
WIRE STRIPPER

Automatically adjusts to insulation/wire diameter This absolutely brilliant stripper is the finest we've ever used.

T 1520

HALF PRICE
$9.50

SUPERB KIT
POWER SUPPLIES

If you're thinking of buying a power supply then buy from us, we are the experts on power supply kits and carry a supply to suit most enthusiast and professional requirements..... READ ON.

BENCH STANDARD
* 3-30v Output @ 1 Amp
* Fully Regulated. Fully Protected from Thermal Overload and Short Circuits
* ETI Design.

K3205..... (PICTURED)..... **$49.50**

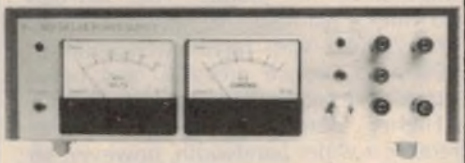
HIGH CURRENT
MICROCOMPUTER PS
* + 5 Volts @ 3 Amps * + 12 Volts @ 2 Amps. – 12 Volts @ 200 milliamps.
This universal design has enough grunt to power most disk drives.

K3350..... **$59.50**

13.8 VOLTS @ 10 AMPS HAM'S & CBER'S
Save the expense of a Mains Powered Rig.

K3250..... **$89.50**

HIGH CURRENT — DUAL METERING



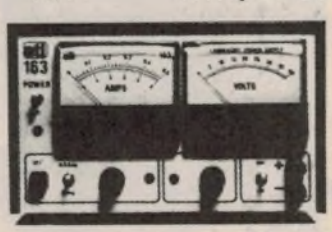
EA SWITCH MODE DESIGN
* 2-50 Volts at massive 175 Watts.
* CLEVER DESIGN — a fully mains isolated supply with a "Switchmode" low voltage circuit.
* Easy to build.

K3300.. (EA MAY, JUNE '83).. **$139.00**
K3301... (10 TURN VOLTAGE CONTROL OPTION)... **$10.00**
K3302..... (± 12V OPTION) EA JULY '83..... **$12.50**

ETI SERIES REGULATOR DESIGN
* 0-40 Volts @ 5 Amps — **thats 200 Watts.**
* Current limiting 0-5 Amps variable.
* Specifications Second to None.
* Free from the hum and noise sometimes associated with other techniques.

A PROFESSIONAL SUPPLY

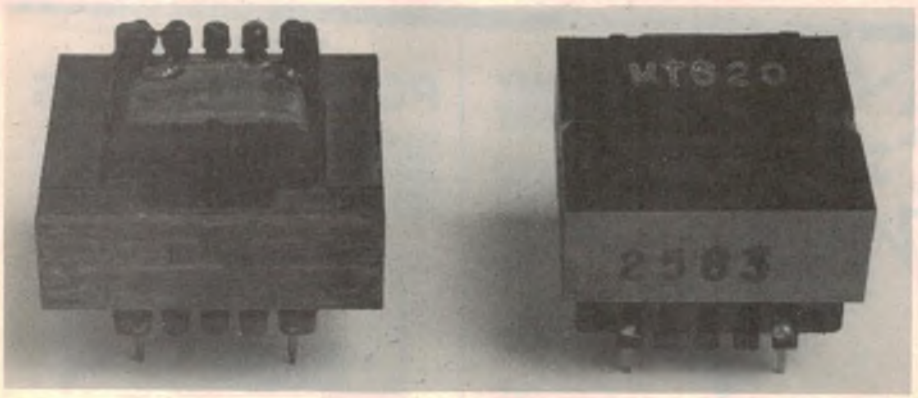
K3325.... (PICTURED).... **$175.00**



FEATURING: VARIABLE CURRENT LIMIT-DUAL METERING

New Products...

Product reviews, releases & services



Telephone isolation transformers from Ferguson

The increasing use of microcomputers has created a demand for modems to link computers via the telephone lines, but Telecom Australia insists on rigid standards of line isolation for such equipment.

To meet this need Ferguson Transformers has added two new Telecom approved line isolation transformers to their range. Both are intended for PCB mounting and are capable of handling most data transmission requirements.

Designated the MT-620 and MT-627, both transformers have a matching impedance of 600Ω. The MT-620 provides a flat response between 300Hz and 2200Hz with rapid attenuation to 20kHz to reduce crosstalk and noise outside the required modem bandwidth.

Higher data transmission speeds require a wider bandwidth, however, so the MT-627 is provided to cover the range from 300Hz to 20kHz.

Both are wholly designed and manufactured in Australia to suit Australian conditions and Telecom requirements.

Other products from Ferguson for the microcomputer market are a new range of mains supply conditioning units.

Appropriately named the "Mini Line Tamers", the range provides four ratings, of 160W, 275W, 550W and 1000W, to meet the needs of all microcomputer systems.

Often computer errors and malfunctions result from fluctuations in the mains supply voltage. These can take the form of short term "spikes" caused by switching machinery on the same mains circuit. Alternatively the mains voltage may rise or fall below the nominal 240VAC.

Ferguson's Mini Line Tamers take care of these problems. They can maintain a nominal 240V AC output for inputs from 190V to 275V and also eliminate power line interference, such as spike voltages caused by lightning.

Where voltage variations are not a problem, but mains borne noise is encountered, a range of noise suppressors is available.

Ferguson engineers have also developed an acoustic treatment to ensure that the Line Tamers operate silently. The units are designed with a vertical format to keep space requirements to a minimum, while extensive use of aluminium extrusions and the encapsulation of the transformer create a rugged, relatively light weight power line conditioner.

Extensive protection circuitry is also built-in, including protection against short circuit of the output and special protective circuitry to guard equipment against power surges at switch-on. As a further safety feature the output sockets are protected by shutters.

"Mini Line Tamers" and Ferguson's line isolation transformers are available from Ferguson Transformers Pty Ltd, 331 High St, Chatswood, NSW, 2067. Phone (02) 407 0261.

Tiny VHF transceiver from Benelec

The Transair TW-260 is a VHF pocket or handheld FM transceiver that the makers claim is the smallest in the world. Measuring 62 x 36 x 120mm (W x D x H) the TW-260 weighs just 340 grams, including the rechargeable batteries.

The TW-260 can operate on up to six channels in any 3MHz segment between 134MHz and 174MHz. The transmitter delivers 2W and rated deviation is ± 5kHz. The double conversion receiver has a sensitivity of 0.3μV for 12dB SINAD, 0.5μV for 20dB of quieting. Audio output is given as 300mW for less than 10% distortion at 1kHz.

The unit is DOC approved and operates from a rechargeable 7.2V 450mAh nickel cadmium battery which has a life of 8 hours at 5% transmit, 5% receive, 90% standby.

An external microphone/speaker socket is provided so that the transceiver may be mounted on a belt and an optional remote handheld mic/speaker unit attached. Two charger units are available to suit the unit; a plugpack unit and a desktop model allowing the transceiver to be slipped into a cradle with two contacts on the bottom to provide connection to the battery.

Further information, including product catalogs, is available from Benelec, 1 Greville St, Randwick, NSW, 2031. Phone (02) 665 8211.

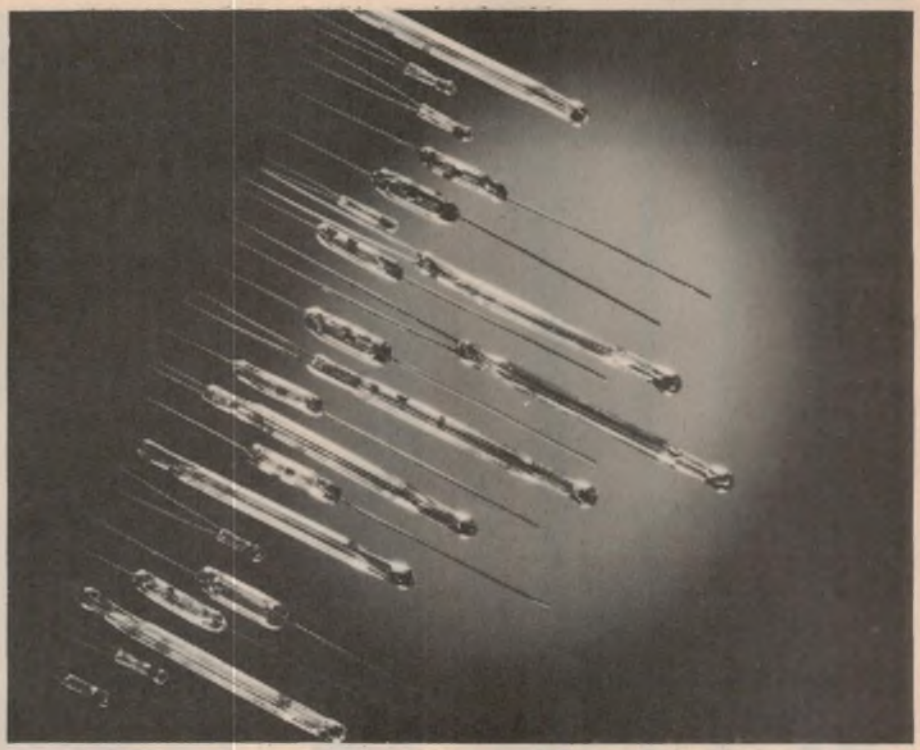
Philips has thermistors

Response time of Philips' new series 626 and 633 series of miniature NTC (negative temperature coefficient) thermistors is less than one second. The miniature bead devices are intended for applications in temperature sensing, measurement, and compensation circuits.

Resistance ranges of 1kΩ to 1MΩ and tolerances of 5, 10 and 20% are available. The 626 series is encapsulated in a glass probe with radial leads and is rated for a maximum power dissipation of 100mW. The 633 series comes in three versions, one a 60mW glass encapsulated type 12mm long and the other naked-bead versions rated for 25mW.

Operating temperature range is −55°C to +300°C for the glass types and −55°C to +200°C for the naked bead versions.

Further information is available from Philips Electronic Components & Materials, 67 Mars Rd, Lane Cove, 2066. Phone (02) 427 0888.



Cabinet Industries to introduce new loudspeaker systems

Cabinet Industries and CI Components Pty Ltd will launch a range of Australian designed and manufactured speaker systems this year. To be known as the "Poly-Pro" series, the range will use the Foster Electric Company's polypropylene cone drivers, enclosed in cabinets computer designed to Thiele and Small parameters.

CI Pty Ltd has employed the acoustic engineering consultants Leembruggen and Connor to design the all-important crossover networks for four models in the Poly Pro series. The top of the range will be the series 500, incorporating two Foster 250mm woofers, two 100mm mid-range drivers and the D025N25 phenol dome tweeter.

Cabinet Industries, formerly HSC Timber Industries, has been manufacturing enclosures for recognised speaker brands, including Acoustic Research and Bose, for many years. CI Components stock and distribute Foster speakers in Australia, and carry stage and PA speakers in addition to the home audio range.

For further information contact the company at PO Box 58, Peakhurst, NSW 2210. Phone (02) 534 1746.

Imark releases new antenna for amateurs

Imark Pty Ltd has released the Hoxin HS-GP23 antenna for the two metre amateur band. It is a three step colinear type for base station applications, and provides a gain of 7.8dB over a quarter-wave ground plane. It has a 2MHz bandwidth with a VSWR of under 1.5:1. Maximum power rating is 100W CW, length is 4.45 metres and weight is 2kg.

Further information is available from the importers, Imark Pty Ltd, 167 Roden St, West Melbourne, Vic 3003. Phone (03) 329 5433.

UGI introduces new digital multimeter

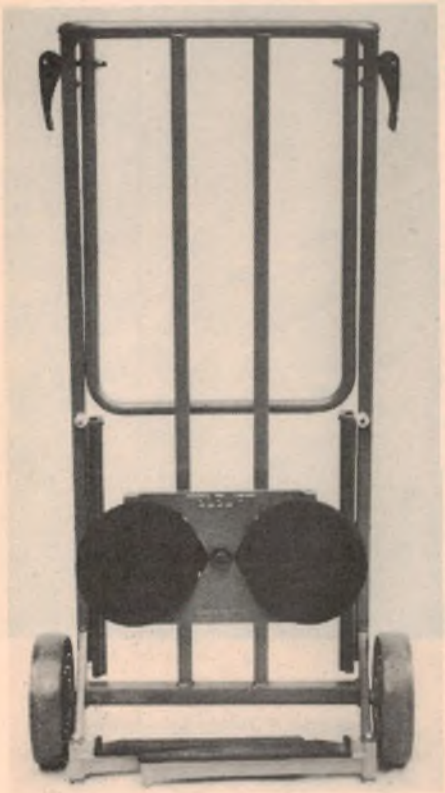
University Graham Instruments now has available a new hand-held digital multimeter, supplied complete with test leads and battery. Features of the instrument include a 12mm high 3½ digit liquid crystal display reading to 1999 and an in-line push-button switch for function and range selection. A fold-away bench stand is also provided to lift the multimeter to a convenient viewing angle.

Input impedance is 10MΩ and ranges provided are 200mV to 1000V DC (with high voltage probes), 200μA to 10A, and 200Ω to 20MΩ. A transistor tester with hfe indication is also provided.

The ohms resistance ranges are protected against the inadvertent application of high voltages and the use of CMOS circuitry makes for low power consumption. Power is provided by a 9V battery although an input for a plugpack adapter is also available.

Further information is available from University Graham Instruments Pty Ltd, 106 Belmore Rd North, Riverwood, NSW 2210. Phone (02) 53 0644.

New Products...



Telelift takes the strain for TV servicemen

An Australian invention, developed with the financial assistance of the Australian Industrial and Research and Development Incentives Board, is now available to eliminate the problem of "TV serviceman back-ache".

The "Telelift" is a unique trolley design which makes the movement of heavy and expensive television receivers an easy one-man job, rather than a back-breaking chore.

Four years of research and development have perfected the design, and Telelift has been field-tested with one of the largest TV rental companies in the UK over the last fifteen months.

The device is a specially designed trolley which incorporates powerful rubber suction pads to grip the faceplate of the TV tube. Once the TV set is locked into place it can be swivelled through a 90° angle to negotiate narrow doorways. During transport the receiver cabinet is supported and protected from damage by rubberised fold-away feet, while road impact and shock is absorbed by radially spoked one-piece moulded plastic wheels.

"Stair-climbers" attached to the sides of the trolley and running on precision sealed bearings reduce the effort required while ascending a flight of stairs and provide a degree of friction for control during descent. The handle of the Telelift is extendable and folds away for stowage in the back of a delivery van. Unloaded weight of the trolley is 9kg and height is 90cm.

The trolley allows TV sets to be lifted and lowered at heights of up to 91cm, making light work of the removal of equipment from a stand or the rear of a van.

As at March this year over 100 Telelift units have been sold in Australia, the UK, and the United States.

Further information is available from Telelift (Australia) Pty Ltd, 23 Atchison St, St Leonards, NSW 2065. Phone (02) 439 6860 or in Melbourne contact Mr Rod Foster on 850 1339.

Stand alone Trackball from Disc Instruments

Disc Instruments has recently released the "Lynx" stand-alone trackball, which uses a freely rotating ball partially enclosed in a housing to input position co-ordinates to computers and terminals.

The distributors emphasise that trackballs take up very little desk space when compared with a "mouse" or digitising pad. The "Lynx" device provides an RS-232C serial output at baud rates from 300 to 19,200 and three user-definable push-buttons for special functions.

The Trackball uses non-contact optical encoding for high resolution and reliability. It is no coincidence that Disc Instruments also manufactures a range of optical encoders, from sub-minature to heavy duty and "explosion proof" versions for use in industrial applications. Full details of the Lynx and the range of encoders is available from the Australian distributor, Associated Controls Pty Ltd, PO Box 21, Padstow, NSW, 2211. Phone (02) 709 5700.

12V rechargeable gel battery

Readers looking for a 12V standby battery for the car alarm published on page 45 of this issue will be interested in the Arista Lab-1. It is a sealed rechargeable lead acid battery with a nominal voltage of 12V and a capacity of 1.2 ampere-hours (60mA discharge at the 20-hour rate.)

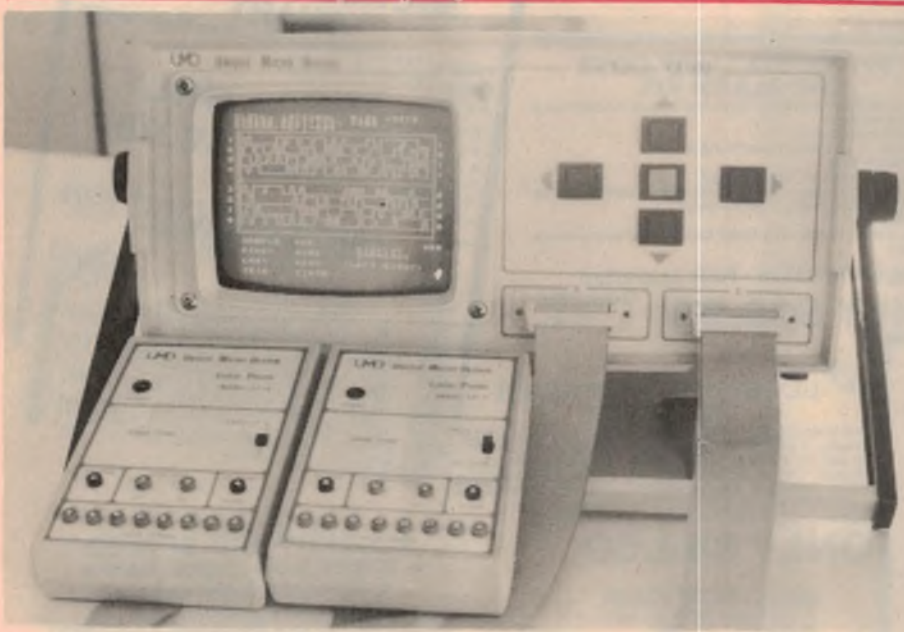
The Lab-1 is suitable for such applications as burglar alarms, emergency lighting, video cameras and portable TV sets. The battery case is made of ABS plastic and measures 100 × 45 × 53mm. Weight is 600 grams. Trade enquiries should be directed to Arista Electronics Pty Ltd, Phone (02) 660 0500.

Minature toggle switches from STC-Cannon

STC-Cannon Components now has available a new series of sub-miniature toggle switches, in either SPDT or DPDT versions rated at 3A at 125VAC.

The switches use a slow-make, slow-break contact mechanism and are suited for low voltage power switching applications. The switch-base is moulded in insulating plastic resin and is resistant to soldering temperatures, humidity and electrical arc tracking.

Further information is available from STC-Cannon Pty Ltd, 248 Wickham Rd, Moorabbin, Vic 3189.



Logic analysers have built-in display

Datac Digital Systems has introduced a new series of logic analysers, the UMD LA-100 range.

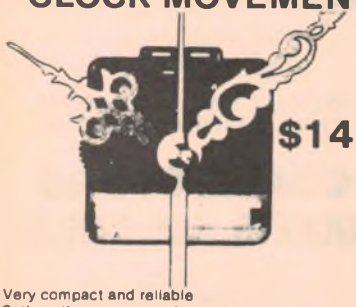
These logic analysers are designed and built in Australia by Unique Micro Design Pty Ltd and are available in 8 and 16-channel versions. Features include an integral CRT display, control by a combination of on-screen menus and simple front panel pushbuttons and data capture rates of up to 10MHz.

A variety of different displays can be selected, with timing or state diagrams, or read-outs in binary, hex or ASCII. An external pod converts the 8-channel model to a 16-channel instrument, or allows the use of eight channels with memory capacity doubled to 512 bits. Two qualifying inputs, such as a clock or strobe signal, can be used in conjunction with each eight channel group in addition to the standard system clock connection.

Further information on the logic analysers is available from Datac Digital Systems Pty Ltd, PO Box 104, Burwood, Vic 3124. (03) 568 6922. In Sydney phone (02) 635 6290.

JAYCAR No.1 AGAIN FOR NEW PRODUCTS AT GREAT PRICES!

QUARTZ CRYSTAL CLOCK MOVEMENT



$14.95

- Very compact and reliable
- Self starting one-second stepping motor has strong torque
- Powered by 1.5V AA battery that lasts for one year
- Supplied with two sets of hands, one short and one long
- ±15 second/month accuracy
- 56mm square, 15mm deep

Complete with data sheet, instructions and wall hanger bracket.
Cat. XC-0100

- NOT CHEAP BUT WHAT IS YOUR LICENCE WORTH?
- THE AUSSIE DETECTOR EXPORTED TO THE USA!

$459.00

RADAR DETECTOR

There are many different detectors on the market. We studied them all and decided there is only one to stock, the best. The fabulous Computer-Heterodyne Micro Eye. The first radar detector with on-board computer. Detectors hanging from the windscreen obstructing vision are out. The compact Micro Eye measures 95mm x 101mm x 38mm, slightly larger than a cigarette box.

It has a range of up to 3km on K band and the X band is up to 3 times that of conventional radar detectors. False alarms have been virtually eliminated since the micro-computer provides the detector with the ability to distinguish between the short pulses of mobile police radar and the constant emissions of microwave burglar alarms. The computer intelligence of the Micro Eye gives it the ability to be the ONLY* detector available which can consistently and reliably pick up the ground speed pulses of mobile police radar. Is your licence worth $459?
Supplied with sunvisor or standard mounting brackets, full instructions and 12 months warranty.
*As stated in the manufacturers technical literature.
Cat. AR-0900

APOLOGY

On page 11 of the April issue of EA the price of the KA 1498 AM tuner kit was incorrect. The correct price for the kit was $229 — not $129 as shown. We apologise to our customers for any inconvenience.

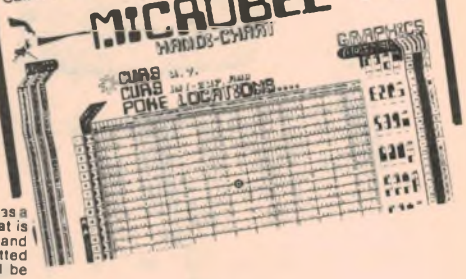
MICROBEE HANDY CHART

This great new wall chart is a must for every MicroBee owner.
It measures 600mm x 740mm.
It gives:

- ★ Screen Poke locations
- ★ Graphic codes
- ● ASCII equivalents
- ★ Memory map
- ● Expansion socket pinouts

Cat. XB-9400

ONLY $6.95



NEW!! "SPARKRITE" LOW COST CAR ALARM KIT

This low cost alarm is ideal for the budget conscious motorist. It has many features:

- ★ 10 amp output relay
- ★ Optional door, bonnet switch input
- ★ Accessory loop
- ★ Horn relay and headlamp output
- ★ Optional entry delay i.e. external disarm switch can be fitted obviating need for entry delay
- ★ Exit delay
- ★ Auto alarm disable. (To meet local noise/enviromental rules)

Cat. KJ-6662

Staggering value - fully imported from the U.K.

ONLY $39.95

UHF/VHF INDOOR

The ultimate indoor antenna - built-in mixer for UHF/VHF/FM - wide frequency band from 40MHz to 890MHz - directional fine tuning possible with variable direction inner loop - easy to mount and will even hang on the wall - 75 ohm impedance with coaxial cable and plug.
Cat. LT-3120

$44.50

NEW!! ULTRASONIC INTRUDER DETECTOR

This fantastic little kit attaches to virtually any car alarm (as a sensor). It sets up an ultrasonic field inside the car that is virtually immune to false triggering. A special transmitter and receiver unit is supplied that can be unobtrusively fitted inside the cabin. Any movement inside the cabin will be detected and a trip signal sent to your car alarm.
Complete kit and instructions. Cat. KJ-6650

ONLY $49.50

SPECIFICATIONS:

- ★ Accuracy - 0.01% ± 1 digit
- ★ Linearity - ± 1 digit
- ★ Samples/Sec - 1.6
- ★ Temperature Stability - 50ppm/°C typical
- ★ Temperature Range - 0-35°C
- ★ Supply Voltage - 7.6 - 15V
- ★ Supply Current - 1mA typical

Maximum DC Input Voltage - ± 20V

NEW

4½ DIGIT LCD DPM 60

★ 200mV fsd ★ Digital Hold ★
★ Bandgap Reference ★
★ 10uV Resolution ★

A new 4½ digit LCD DPM offering levels of performance, low current consumption and compact size never previously available. The DPM 60 features auto-zero, auto-polarity, a logic switched 200mV or 2V fsd, digital hold, programmable decimal points and a 1mA current consumption. Automatic low battery indication and 'continuity' flags are built into the 10mm 4½ digit display. The DPM 60 can be readily scaled by the user to indicate many different units, amps, volts, ohms etc. Supplied complete with fixing bezel, clips and connector, the DPM 60 will suit many applications calling for low-cost, high accuracy measurements in portable or bench instruments.
Cat. QP-5620

MICRON DATA CASSETTE

A recorder designed solely for the purpose of data storage now at an unbelievable price.

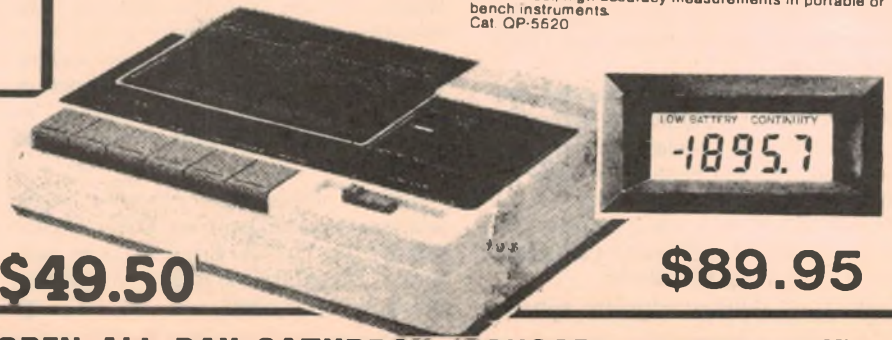
- ● Slide volume control a must for quick checking of levels
- ● tape counter a must for easy location of programs
- ● Inbuilt piezo transducer enables you to listen to tape

6V DC operation - use with MP-3010 plug pack ensures low hum level (optional $12.50)

- ● Robust construction of both internal mechanism's and external case

Cat. XC-4900

"MANY THANKS CLIVE"



$49.50

$89.95

STOP PRESS!! **NOW OPEN ALL DAY SATURDAY (CONCORD STORE ONLY)**

UNBELIEVABLE 'PHILIPS' SPEAKER BARGAIN

We have made a massive scoop purchase of genuine quality **Philips** European made Hi Fi speakers. They are so good they are used in the fabulous ETI 4000 series Hi Fi. If you thought the 4000/1 or 4000/2 systems were out of reach of your pocket - THINK AGAIN!

SAVE UP TO $105

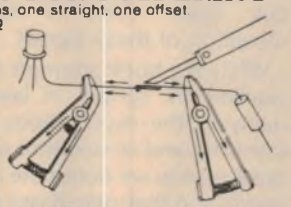
WOOFER AD12250/W8
NORMALLY $99.50 SAVE $30.00
THIS MONTH $69.50
LOW MID AD70620/M8
NORMALLY $32.50 SAVE $5.00
THIS MONTH $27.50
HIGH MID AD02161/SQ8
NORMALLY $44.95 SAVE $5.00
THIS MONTH $44.95
TWEETER AD0160/T8
NORMALLY $19.95 SAVE $4.00
THIS MONTH $15.95

$201.90 value for $157.90 SAVE $44
EVEN CHEAPER for a stereo set i.e. 2 each of the above **$315.80**
SPECIAL 8 PIECE SET PRICE $299!!
Normal price for 8 speaker set $399!!
Crossovers 2 x 4 (ETI4000/1) $200 Cat. CX-2637
2 x 3 (ETI4000/2) $129.50 Cat. CX-2627

NEW - HEATSINK TYPE CLAMPS FOR SOLDERING

A pair of clamps, one straight, one offset.
Cat. TS-1652

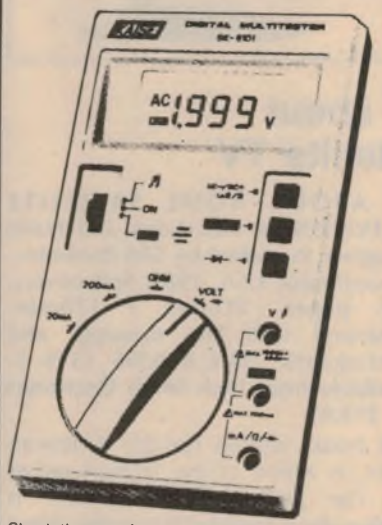
$3.50



BACK IN STOCK - WE HOPE!! SUPER BRIGHT LED's

200mCd @ 20mA Red 5mm Cat. ZD-1790
1-9 69¢ 10 up 62¢ ea
500 mCd @ 20mA Red 5mm Cat. ZD-1792
1-9 $2.95 10 up $2.50 each
80mCd @ 20mA Green 5mm Cat. ZD-1794
1-9 95¢ 10 up 85¢ each
160mCd @ 20mA Yellow 5mm Cat. ZD-1795
1-9 95¢ 10 up 85¢ each
Remember! Your average 15 cent Red LED is generally around 1.8mCd at 20mA so imagine what you can do with these. WILL GIVE USEFUL LIGHT DOWN TO 1mA!!

KAISE DIGITAL MULTIMETER SK 6100



Check the specifications/features of this superb Digital Multimeter.

- Autoranging with manual override
- Auto polarity displays - sign when probes reversed
- Overange indication "Blink" and buzzer warning
- Low battery warning BATT sign shows
- Sampling rate 2 times second
- Power supply 2 x A penlight batteries (300 hours continuous operation)
- Fuse protected, spare fuse provided
- Zero adjustment, zero adjust button - a must if you change test probes
- LCD display, magnificent clear readout
- Inbuilt buzzer, available for continuity test, overload warning and switch warning
- Ranges ±1000V DC/600V AC, AC and DC current, resistance 200 (resolution 0.1 ohm) to 2000K ohm (resolution 1K ohm) in 5 ranges autoranging
- Accuracy 0.5% DC, 0.8% AC

Cat. QM-1525

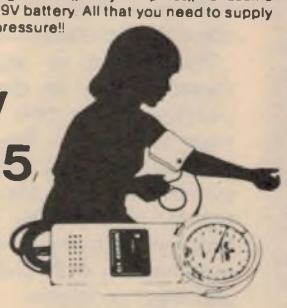
$59.95

BLOOD-PRESSURE MEASURING MACHINE

Not a kit, tested and guaranteed.
One of the best presented items that we have seen for a long time.
This high quality SPHYGMOMANOMETER (to use the technical term) enables you to perform accurate blood pressure measurements at home without a doctor. (You should consult a doctor, of course, to interpret the readings)
The unit includes inflatable cuff, pressure gauge, hand pump and inbuilt pressure transducer which eliminates the need for a stethoscope.
Included is a comprehensive instruction booklet, blood pressure record keeping charts (plenty of spares), handsome vinyl case and even a 9V battery. All that you need to supply is an arm and blood pressure!!
Cat. QM-6100

only $79.95

NEW!!!



NEW!!!

HEART RATE MONITOR

Not a kit. Built, tested and guaranteed.
This fully self-contained unit enables you to monitor your pulse rate - anywhere!!
The unit features large, easy to read LED display and comfortable finger grip pulse sensor.
An exclusive feature is the bracket that enables you to mount the unit to tubular objects such as a bike (or exercise bike), weight training equipment etc.
NOW you can monitor your heartbeat accurately and easily while *in the middle* of exercise!!
The comprehensive booklet gives you explicit instructions on use of the monitor as well as mounting guidelines.
Once again this is a beautifully presented piece of equipment. Included, are mounting bracket, vinyl case, instructions and 9V battery.
Cat. QM-6110

Jaycar Incorporating **ELECTRONIC AGENCIES**

SYDNEY SHOWROOMS
117 YORK STREET - PHONE: (02) 264 6688 and (02) 267 1614
TELEX: 72293
CARLINGFORD
Cnr. CARLINGFORD & PENNANT HILLS ROAD - PHONE: (02) 872 4444
CONCORD
115 - 117 PARRAMATTA ROAD - PHONE: (02) 745 3077
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Books & Literature

All about Satellite TV

ALL ABOUT HOME SATELLITE TELEVISION by Rick Cook and Frank Vaughan. Published by TAB Books Inc, Pennsylvania, USA, 1983. Soft covers, 326 pages, 210mm x 130mm, illustrated with line drawings and photographs. ISBN 0 8306 1519 9. Available from Dick Smith Electronics for $14.95.

This book, written for the American market, is aimed at the layman rather than the professional engineer. It describes how satellite TV works, offers practical advice on equipment selection and installation, and discusses the pros and cons of satellite TV as it relates to the US scene: It is a practical alternative to network and cable TV? Can you set up your own ground station? What will it cost? What are the legal restrictions? What services are available?

Unfortunately, for the Australian reader who may be looking for advance information on satellite TV in anticipation of AUSSAT and the direct broadcasting service it will bring, this book will prove of little value. First, there are technical differences. All the satellites discussed in this book operate in the 4GHz (downlink) and 6GHz (uplink) bands, whereas Australia's system is to use 12GHz (downlink) and 14GHz (uplink) bands. As a result, typical performance figures for dishes and associated equipment, quoted in this book, have little bearing on the local scene.

Just as important are the legal and commercial differences. The United States does not appear to have a direct broadcasting service as planned for Australia and, in fact, part of the book is devoted to debating the possibility and desirability of such a service. Most satellite TV reception in the US is from satellites relaying signals on behalf of cable distribution networks, who regard private ground stations as illegal. There are some satellite subscription services but, again, there is much "illegal" reception of these signals.

While the book attempts to explain the satellite TV system in layman's terms, many of the explanations are far from satisfying and of doubtful accuracy. At a quick glance we noted the following: the suggestion that only those signals above 1000MHz will penetrate the Heaviside layer; that the spacing between satellites in space is limited by the weak signals; the suggestion that the TV signals through the satellite are (time division) multiplexed and that they can still be received without the need for any special decoding.

Over one third of the book (110 pages) is devoted to appendices covering satellites and frequency allocations and, while these may be useful to US readers, they are of little value in Australia. Also, some, at least, of these lists have been so reduced in size that they have printed very poorly and are difficult to read.

Chapter 5 – Getting Stated in Satellite Television – probably comes closest to providing some useful background for the local scene. In spite of the technical differences already noted it does offer some broad information on the mechanics of erecting a dish, and some of the procedures necessary to determine the direction in which it must be pointed. While needing to be transfered to the southern hemisphere, it may still be useful.

Otherwise the book would be most useful in providing an insight into the US TV – and particularly the satellite TV – scene, the many legal problems which have arisen, and the obvious difficulty there is going to be in getting the mess sorted out.

Not particularly recommended. (P.G.W.)

Introduction to Satellite TV

INTRODUCTION TO SATELLITE TV by Chris Bowick and Tim Kearney. Published by Howard W. Sams and Company Inc, Indianapolis, USA. Soft covers, 142 pages, 215mm x 135mm. Illustrated with line drawings and photographs. ISBN 0 672 21978 6. Recommended price, $17.95.

Like the book reviewed above (All About Home Satellite Television) this book attempts to present the complexities of the subject at layman's level, but with more emphasis on basic principles than the "do-it-yourself" aspect.

Just how well the authors have succeeded depends a lot on the reader's technical background. The true layman – the non-technical man-in-the-street – would undoubtedly be lost (which is not necessarily a criticism), whereas readers of this magazine could probably digest most of it. In short, it is a much better effort than the previous one.

That is not to say that it has no shortcomings. In the early chapters, particularly, the authors allow themselves to be sidetracked in qualifying and expanding basic statements, and also become unduly repetitive in places. There is also the problem of trying to combine technical explanations with political, commercial, and legal problems.

And, as far as the Australian reader is concerned, the points raised in the previous review concerning the differences between the US 4GHz/6GHz system and the 12GHz/14GHz system to be used by AUSSAT still apply. However, there is a brief appendix devoted to the latter system.

The later chapters fare better than the early ones, and the reader with a general technical background, but lacking an

understanding of satellite systems, should at least obtain a useful grounding from it.

The chapter headings are as follows: Chapter 1, Satellite Communications. (2) The Satellite TV System. (3) Receiving Antennas and Low Noise Amplifiers. (4) The Satellite TV Receiver. Appendix A, Glossary. (B) Direct Broadcast System. (C) Locating the Satellites and Aiming the Antenna. There is also a short bibliography.

For anyone wanting to "update" to satellite TV thinking, this book is probably the best we have seen to date and, at the price quoted, would seem to be reasonable value for money.

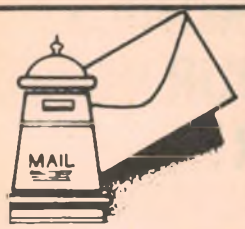
Our copy from Technical Book and Magazine Company Pty Ltd, 289 Swanston St, Melbourne, Victoria, 3000. (P.G.W.)

Laser technology

PRINCIPLES & PRACTICE OF LASER TECHNOLOGY by H. M. Muncheryan. Published 1983 by Tab Books Inc, Blue Ridge Summit, Pa. Soft covers, 130 x 210mm, 298 pages. Illustrated with photos and diagrams. ISBN 0 8 8306 1529 6. Distributed in Australia by Thomas Nelson Australia. $25.00.

This text should not be confused with another book by the same author which was reviewed in the December 1983 issue. This new book is quite different in content although the subject headings and treatment are similar. And in spite of the fact that the new book was published more recently it does not seem to be any more up to date. It does not cover the laser technology used in the latest compact disc players nor does it mention recent laser applications in surveying and agriculture.

In view of the fact that the earlier book is available in hard cover form at a lower price, it would be the better buy. (L.D.S.)



Letters to the editor

More praise for the serviceman

We too would like to thank the Serviceman for the odd tip that comes along. For us it was a Toshiba C2022 series. There is no doubt about it; whoever he is he's a clever so and so.

This brings me to the latest tale (March '84). I felt the point the serviceman brings up is more obvious in a small town where, after some five years in business, one gets to know just about every piece of equipment in existence for twenty miles around. Whether it be on/off volume controls on portable colour TV sets or cassette belts or HF transceivers, for the most part faults come in batches of up to five or six. Over the years it has become known as "knob", "belt", "audio IC" or "tranny" week etc.

We have had at regular intervals up to ten cassette radios with scrambled volume controls – all various models and ages, which I feel disproves the "faulty batch" theory. I have it from a reliable source that it is caused by astrological influences, which after all is as good an explanation as any. Or maybe there is such a thing as electronic biorhythms!

Nevertheless it is strange, as the consistent problem is welcome, proving if nothing else that the mysterious ways of the planets favour the serviceman.

Please do not change the style of your magazine. A book full of glossy advertising does not make for interesting reading.

M. Bortella,
Service Manager,
Hydra Electronic Services, WA.

No levy on blank audio tapes

If the record companies and their distribution networks are really concerned about illicit copying of their "album" recordings, they should take a good listen to the material that is released on prerecorded cassette tape. What a dismal, below standard product is on offer to the public (Dolby NR doesn't seem to help either). And consider that the tapes are available at usually the same price as the record. This must represent a lucrative part of their turnover.

The conscious tape (copy) enthusiast can buy quantity (10s and 20s) top-quality blank 90 minute tapes for $5.00. The recording companies should be able to bulk buy top quality tapes, of 45 to 50 minutes duration, for less than half that price. And they can still reproduce dozens of them in a matter of a few minutes. Add to that the ease of storing and transporting, no buckling problems and surface damage, and no expensive multi-coloured glossy covers and sleeves.

No, I am with you Mr Editor, no levy on blank audio tapes.

Thank you for a thoroughly enjoyable magazine.

E. Van Rayvac,
Seacombe Heights, SA.

Op Amps praised — but with a gripe

I am writing to comment on the article "Op Amps Explained", by Bryan Maher, in the March 1984 issue of "Electronics Australia". This is a well presented article, particularly in that, early in the piece, it shows that the principles originate in, and are readily applied to, things other than electronics.

This is a refreshing approach and it helps to show that electronics is only a part of the whole system of things, and not an entity in itself. I can only hope that this approach will be maintained in future articles. Unfortunately, the rule seems to be that, once the newness has worn off, the style changes and the script becomes less enjoyable to read.

One point that I hope will be tackled in future issues is that of split supply rails. They are a darn nuisance. I would like to know how they came about and why they are necessary.

I also have a gripe about something that occurs frequently in electronics magazines. It is that the diagrams and illustrations are rarely in the right place. This is disastrous in an article of this nature because, as the reading gets heavy, one has to concentrate carefully and then find that you have to flip back a page or two to look at a specific diagram. Most of the time both the script and the relative diagram are complex and would be better on the same page.

C. Serreyn,
Whyalla, SA

Compact digital discs

I read in March EA the letter "Compact disc and quality control". I, likewise, was one of the very first purchasers of a Sony CDP101. There is a lot wrong with compact discs which could easily be dealt with in the early stages by consumer consensus. I have discovered two major faults not commented on.

Firstly, hiss and tape joins (?). The hiss at the beginning of Beethoven's Violin Concerto (Kremer-Marriner) is disgusting and the Zamfir Pan Flute recording has about a 2Hz excursion that is frightening during the half second it is on.

Secondly, many compact discs have only half the program material on them that they could have. Considering the high price of the discs, I feel that we are being ripped off. You really need to listen to and look at your discs before you buy them. If the disc is faulty and/or not fully recorded then make sure that it does not sell. If we accept rubbish, that's what we will be offered.

V. Marcollo,
Traralgon, Vic.

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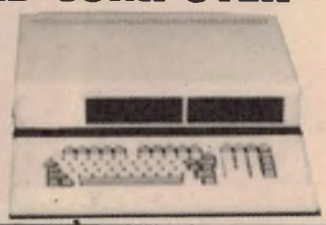

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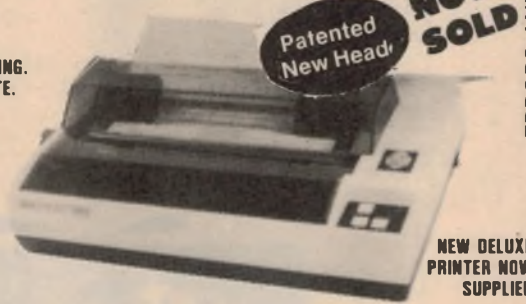

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Enhanced Microsoft BASIC?	YES	NO
Size of BASIC interpreter in ROM	24K	10K
Keyboard — number of keys	81	63
Numeric keypad	YES	NO
Function keys inbuilt	8	2
80-column text display inbuilt	YES	NO

FEATURE	CAT	Apple IIe
RGB colour output as standard	YES	NO
280x192 graphics: number of colours	8	6
560x192 graphics in colour	YES	NO
Sound channels	4	1
Disk drive capacity	140K	140K
Centronics type printer port inbuilt	YES	NO
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REVIEWS OF RECENT
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TWO-PIANO RECITAL

Rachmaninoff. Suite No. 2, Op 17. Ravel. La Valse. Lutos Lawsky – Variations on a theme by Paganini. Duo Pianists Martha Argerich and Nelson Freiere. Philips digital disc 651 4369.

The cover of this unusual disc shows the two artists in a pose that suggests they're getting ready for a first class brawl. In a way this reflects their style on the record inside. The players often seem to be competing with each other as to who can produce the greatest number of notes in the shortest time.

The waltz – the second item in the Rachmaninoff Suite – produces a torrent of notes that completely destroys any idea of ballroom procedure. All that suggests the well-respected form is 3/4 time taken at a speed that outlaws any tendency. Indeed it all sounds a bit pugnacious, except for a brief tune.

The next piece – a Romance – is all a bit reverberant and attention should be paid to primary adjustment of controls to get best effect. Here there are moments of great charm except when one piano seems to be trying to outdo the other with cascades of notes.

The concluding Tarentella offers another torrential outpouring of notes. Everything seems to be going too fast – a fault it shares with much of the rest of the Suite. The abrupt ending seems to leave everything up in the air. Also the blank space left over on both sides of the disc suggests more music could have easily been added.

I prefer the gorgeous orchestral version of Ravel's La Valse. In its two-piano form here there seem to be far too many notes. There are also some Chopinesque rubatos here and there that are alien to the text, glissandos skate up and down the keyboards and there is again a sense of urgent hurry. There are spots where the melody gets entirely lost under the weight of the accompaniment.

The recital ends with a short set of Variations by Lutoslawski. There is an amusing statement of the Theme which is in nursery rhyme form and the brief rest goes very well indeed. The disc's chief interest, I venture to add, will be in its curiosity. (J.R.)

STRAUSS

Ein Heldenleben. Tone Poem. New York Philharmonic Orchestra conducted by Zubin Mehta, Glenn Dicterow (violin). CBS Digital Disc. D 377 56.

A couple of issues ago I reviewed another recording of Heldenleben. That was analog and this is digital and there is little to choose between the two. Perhaps the strings sound a little fuller in the previous version. But not long after the opening the complex bit of scoring seems directionless. To balance this, the ensuing "critics" bit sounds beautifully clear – and spiteful.

It is clear from the start that Mehta has the measure of Strauss at his tallest – if not greatest. Listening to a second reading so soon after the first exposes the inflationary tendency of the piece. In the first place Strauss obviously casts himself in the hero's role, a quite characteristic gesture. Next, after the second hearing, the piece seems much too long.

But despite the close count of merits in both readings, Mehta's reading is a trifle more humanised than his rival's. This difference stands out in their different treatments of the love passages where Mehta gets a surge on the male part of the narrative that is absent in his competitor's performance. Both solo violinists are fine as the garrulous, skittish wife though Mehta's tone is a trifle more modest than Osawa's full-voiced version. The technique of both in these difficult passages is dazzling for orchestral players.

Mehta wins on the heroic and romantic angle and his battle scene emerges a bit clearer. In both, Strauss emerges victor in an ennobled version of the first subject. Here is Strauss at his tallest, fast dwindling in size as he contemplates the vapid earlier incidents in his life in the "fruits of peace" section, some of it William Tellised on the cor anglais.

As I stated at the outset there is little to choose between the two recordings and I'll leave the ultimate choice to you. (J.R.)

RIMSKY-KORSAKOFF

Capriccio Espagnol. May Night Overture. Suite from Sadko. Suite from Snowmaiden. Philips digital disc. 6514 306.

The size of the type used on the cover for the Capriccio is likely to make one overlook the three other mellifluous Rimsky pieces also recorded on this disc. The Capriccio is festively recorded, the digital process adding clarity at the expense of bloom to the exquisite scoring.

Zinman's handling of the opening Alborado is a little heavy-handed for a dawn serenade, more likely to infuriate the neighbours than to charm a beloved. But the rest of the movements go well enough, even brilliantly. It is unfortunate that the introduction to the main gipsy part, a passage notable for its original rhythmic layout, is quiet enough to be inaudible. This is such an original piece of scoring that it is a pity it is lost.

But the rest of this invigorating movement goes along scintillatingly with just the right carefree spirit.

The overture to the opera May Night is

still more responsive to digital treatment. Its many changes of mood and tempos are scrupulously observed. The whole is a brilliant parody of Glinka. In the suite from the opera Sadko the underwater bits are fine but the sound grows a bit confusing in the fortissimos.

The Dance of the Birds from the opera The Snowmaiden is great fun and I am happy to add that the women sing to suit Western ears and without the usual rasping tone of Eastern European women's voices. This piece also parodies Glinka. The Dance of the Clowns comes off very well. Altogether a nice relaxing record to listen to. (J.R.)

D'INDY-FRANCK-FAURE

D'INDY: Symphony for orchestra and piano on a French Mountaineer's song.
FRANCK: Symphonic Variations for Piano and Orchestra.
FAURE: Ballade for Piano and Orchestra. Philippe Entremont (piano) and the Philharmonia Orchestra conducted by Charles Dutoit.
CBS Analog Disc CX74192.

Here is a coupling of good pieces marred by indifferent recording. The early part of the D'Indy is very congested and reverberant. Entremont plays very well indeed without fuss or false expression. But the background is foggy with much distortion.

The balance also is all to blazes. It is an example of analog at its worst.

On the second side the Franck Variations is just as bad. Reverberation hangs over it like a thick fog. It is difficult to imagine how it got out to the public. And the Faure Ballade is no better.

What can be heard of the Philharmonia under Charles Dutoit is very much to their credit. Here is one I cannot recommend. (J.R.)

SUPER-CUT 1812

Tchaikovsky: 1812 Overture; Cappriccio Italien; "Cossack Dance" from Mazeppa. Played by the Cincinnati Symphony Orchestra conducted by Erich Kunzel. Telarc LP DGQR-10041 limited edition UHQR "Super-cut".

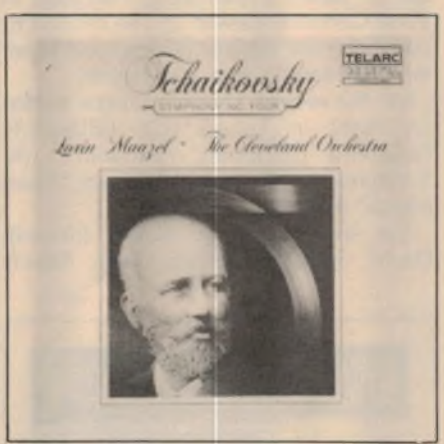
I would hesitate to repeat what has already been said about this recording, the most recent discussion being in "Forum" for January. It should be sufficient to confirm that this is the famous – or notorious – performance of the "1812" into which Telarc engineers mixed the sound of separately recorded carillon bells, plus 16 thunderous shots from period cannon.

What distinguishes this version is that it is a "limited edition UHQR super-cut" LP

pressing, issued for ultra-enthusiasts and collectors.

UHQR stands for Ultra-High-Performance-Quality Recording, produced by the Victor Company of Japan on special quality super vinyl. The pressings are much thicker, heavier and flatter than normal, with superior electrical performance and more resistant to wear.

While intended to be ultimate examples of phono record technology, discs like this are reportedly treated overseas like rare stamps or rare coins, changing hands for hundreds of dollars. Whether the same applies here I wouldn't know but the fact is that a few copies of the "1812" supercut are still available here – probably the remaining few in the world. If you have around $100 to spare and you want one, get in touch with PC Stereo Pty Ltd, PO Box 272, Mt Gravatt, Qld 4122. (W.N.W.)



TCHAIKOVSKY

Symphony No. 4 in F minor, Op 36. Played by the Cleveland Orchestra conducted by Lorin Maazel. Telarc compact disc CD-80047. (From PC Stereo Pty Ltd, PO Box 272, Mt Gravatt, Qld 4122.)

Recorded in May, 1979, in the Masonic Auditorium, Cleveland USA, this is one of the recordings which helped focus the audiophile spotlight on Telarc and on engineer Jack Renner's approach: three Schoeps microphones, no "spotlighting" or monitoring during the performance, transformerless preamps and Soundstream digital tape mastering.

First issued in an audiophile LP version, the recording won high praise from the outset for its technical quality but, commercially, it faced the problem of having to sell at a higher price against a number of major-company releases. Since then, however, it has been established and accepted in its own right.

Available now on a Matsushita-made compact disc, the merits of the original recording are further highlighted. In complete contrast to the uninspiring jacket design, the opening stanza of the first movement, Andante Sostenuto, is rich in sonic colour with bass, treble, overtones and acoustic ambience a promise of things to come.

In fact, if you want a quick sampling of the sound texture and the dynamic range, it is necessary only to push the Play/Next pad three more times and listen for a minute or so to the start of the remaining movements: Andantino; Scherzo (Pizzicato ostinato); Finale – this, without readjusting the volume control. My tip is that you'll want to hear more, so be warned!

The booklet which comes with the recording contains biographical notes on the composer and his own observations about the motivation for the composition – observations which may have been somewhat tongue-in-cheek. That is by the way, however. If you're in the market for an audiophile version of the Tchaikovsky Fourth, this one is well worth considering. (W.N.W.)

SCHUMANN, LISZT

Fantasia in C, Op 17 (Schumann). Rhapsody Espagnole (Liszt). Song transcriptions of Schubert and Schumann (Liszt). Nina Lelchuk, piano. Digitally mastered LP album. Telarc DG-10075. [From PC Stereo Pty Ltd, PO Box 272, Mt Gravatt, Qld 4022 Phone (07) 343 1612.]

Brilliant as a child musician, Nina Lelchuk was admitted to the Moscow Conservatory at 13 – four years before the normal age for admission – and, after eight years of training, graduated with a doctorate in 1965. Even before then, she had attracted the attention of conductor Charles Munch in a Paris competition and won high praise in the Van Cliburn competition in Fort Worth, Texas.

However, while she performed freely in the Soviet bloc countries she had little

Records & Tapes

opportunity to record and remained relatively unknown in the West. Her fellow graduate Vladimir Ashkenazy moved to America in 1963 but it was not until many years later that Nina Lelchuk followed suit, making her debut as a US citizen in Carnegie Hall in October 1980. What we have here is her first American recording, made in April 1982, in Houghton Chapel, Wellesley College, Massachusetts.

Schumann's Fantasia in C, composed and published in the period 1836-39 and dedicated to Liszt, comprises three movements. The first (13' 52") is passionately phrased, the second (7' 16") moderate but energetic and the third (11' 04") gentle by comparison. The recording is impeccable, both musically and technically.

However, Liszt's Rhapsodie Espagnole (12' 35") which opens side two, provides the sonic spectacle of the 58-minute performance. With a soloist of lesser ability, and a recording system of lesser merit, the sparkling cascade of notes which mimic the Spanish sound would simply be a blur. But there is no blur here; the notes cascade from the Steinway like handfuls of coloured beads.

In sharp contrast to Rhapsodie Espagnole, Nina Lelchuk then indulges her propensity for making the piano sing, with transcriptions from Lieder: Track 2 from "Der Muller und der Bach" Schubert/Liszt (5' 50"); track 3 "Aufenthalt" Schubert/Liszt (3' 32"); track 4 "Widmung" Schumann/Liszt (4' 16").

Played gently, sensitively yet purposefully, these short items will beguile and relax, rounding off a very commendable introductory album.

As far as the recording itself is concerned, there is not the slightest suggestion of noise, distortion or overload to mar the excellent sound. (W.N.W.)

JAZZ ON CD

Night in Tunisia. Art Blakey and the Jazz Messengers. Philips compact disc 800 064-2.

Those who invest in this Philips jazz recording will look in vain for the usual multi-page information booklet. What you get is a cover with a few pictures, a run-down of the CD system in three languages, a list of the titles, the names of the musicians and production credits. That's all.

In fact, the recording was made in the Victor studios in Tokyo on February 12, 1979 – and it must have been quite a day. Art Blakey and his Jazz Messengers were involved in two complete and separate sessions, one for a direct-cut disc recording, and the other for a digital master tape.

In due course, both versions were issued in Japan on the Philips label: "Direct Session" (RJD-4) and "Digital Session" (RJ-7483). The titles, names and credits on the respective back covers were in English but the information sheet inside was in Japanese. They were imported into Australia in that form and released by MR Acoustics of Annerley, Qld, during 1981.

The CD version, now being distributed through Philips, is from the same master as the "Digital Session" LP, and the names, titles and credits are as given on the LP jacket. Presumably, Polygram in West Germany passed up the chance to transcribe the original background sheet into German, French and English!

For the record, there are three tracks: "A Night in Tunisia" (D. Gillespie/F. Paparelli) 18.00min; "Moanin'" (B. Timmins/J. C. Henricks) 9.41min; "Blues March" (B. Golson) 6.37min.

The musicians: Art Blakey (drums); David Schnitter (tenor sax); Robert Watson (alto sax); Valery Ponamarev (trumpet); James Williams (piano); Dennis Irwin (bass). They turn on 34 minutes of free-wheeling jazz, which should appeal to devotees of the style.

Technically, the sound quality on the compact disc is fine, as it was on the other two versions, in their day. More than that I am not prepared to say. Busy jazz like this does not expose the noise floor to any extent, nor does it challenge the full dynamic range. As for the texture of the sound recorded, who can say what is the correct amount of "shimmer" on a top-hat or "edge" to an overblown trumpet?

Let's just say that, if you're into Art Blakey's kind of jazz, it will be brought to you faithfully by this new CD version. (W.N.W.)

TOP GOSPEL SONGS

The Very Best: The top ten songs of 1982. Word stereo LP, WSB-8909. [From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135. Phone (03) 729 3777].

Each year, the Gospel Music Association, based in Nashville, Tennessee, USA, polls its members to select the ten best Gospel songs for the year. Grouped on this album are the songs selected for 1982.

The impact of the album is rather like that of a sampler disc, with different artists and different styles providing a variety that will please some and irritate others. The songs are relatively new, of course, again with the same potential: appealing to the "now" generation but not to those who are convinced that they don't write 'em anymore like they used to!

Without buying into that one, I list the track titles and artists: How Majestic is Your Name (Sandi Patti); I Have Decided (Bill Gaither Trio); El-Shaddai (Amy Grant); He's Still Working On Me (The Hemphills); He Will Carry You (Scott

Wesley Brown); Sing Your Praise to the Lord (Amy Grant); I Saw the Lord (Dallas Holm); He Set My Life to Music (Barbara Mandrell); Canaanland is Just in Sight (Florida Boys); We Shall Behold Him (Sandi Patti).

With artists of that calibre and backing, it is scarcely necessary to add that the performances are first-rate in their own category – from soft rock, through rhythm to theme solos.

Unfortunately, I was less than impressed by the technical quality of the disc. While the response was wide, and the noise background low, there was a distinct tendency to "edginess" on high level signals in the middle register. It may well pass unnoticed by some listeners on some systems but it's scarcely a disc that I could commend to hifi buffs. (W.N.W.)

DIGITAL RE-MAKE

David Bowie: Golden Years. Digitally re-mastered stereo LP. RCA APLI-4792.

The endorsement "digitally re-mastered" can mean something or nothing, depending on the stage at which the source material has been digitally encoded. If digital copies have been made from the original analog masters, the ultimate quality can be excellent, with little of the distortion and noise build-up that occurs with analog processing.

I would judge that this approach has been adopted for the production of this compilation of David Bowie songs, which spans the decade 1973-83. The quality throughout is both excellent and very even and, if you want to induce premature deafness by playing it at disco level, it will certainly stand that sort of treatment!

For Bowie fans, the track titles are: Fashion – Golden Years – Red Sails – Joe The Lion – Look Back In Anger – Scary Monsters (and Super Creeps) – I Can't Explain – Wild Is The Wind – Ashes to Ashes. The total playing time is just over 36 minutes. (W.N.W.)

SOUND OF BRASS

American Brass Quintet plays Renaissance, Elizabethan and Baroque music. Delos compact disc D/CD 3003. [From P. C. Stereo Pty Ltd, PO Box 272, Mt Gravatt, Qld 4122. Phone (07)343 1612.

Although this performance dates back to March, 1979, there is no need to discount the recording in any way by reason of its age. It was made in the Masonic Temple Auditorium, New York, well known as a recording venue, using B&K high-SPL condenser microphones and preamplifiers, battery-powered Studer mixer and Soundstream digital tape recorder. It is almost certain that the signal would have been transferred digitally to compact disc via a Studer Sampling Frequency Converter. (Nov '83 issue, p39)

Not surprisingly, what comes through really is the sound of brass – normally involving two trumpets, tenor trombone, bass trombone and French horn, with small D trumpets and cornets as variants. The deeper toned instruments sound particularly full and rich, quite distinct from the incisive trumpets. Indeed, it is this very distinction which so uniquely exposes the structure of the music, particularly when played by a virtuoso group like the American Brass Quintet.

I must concede, however, that some may question the legitimacy of a souped-up brass-spectacular version of music conceived for the instruments and the mood of another era. If the recording is not for you on that account, so be it!

There are 19 tracks in all, averaging a little over two minutes each. They include "Battle Suite" (Scheidt), a selection of English Consort Music and, by way of a complete change, two segments from Bach's "Art of the Fugue". Then follow three German Festive Sonatas, two of Elizabethan Fancies (fantasies) and four of Venetian Baroque.

You can play them all at restricted volume, if that is your mood but, if you really want to hear "the sound of brass", you need to set the listening level at your ears to what it would be if you were seated in the auditorium. You'll realise, then, that this is a true audiophile recording of a fine performance – legitimate or not! (W.N.W.)

MORE MEMORABILIA

Elvis, Volume 4. A Legendary Performer. Mono and stereo LP, RCA, CPL-14848.

How do you produce yet another album for a seemingly insatiable market, when you've exhausted your supply of source material?

Answer: You search once again through the tape racks, looking for discarded material from recording studios, films, or TV and radio broadcasts.

On side 1 "When It Rains, It Really Pours" is noisy mono from a rehearsal session around 1954; "Interview" (1956) turns out to be a couple of scrappy fragments; "One Night" (1958) is badly distorted mono; "I'm Beginning to Forget You", also distorted, is a control room discard; "Mona Lisa" is marred by distortion and a tentative guitar accompaniment.

I doubt that even fans would relish much more of this sort of thing but the standard improves from there on and through side two. Most of the songs are marked "Unreleased", being previously unused takes from films or unused segments from broadcasts or concerts up to June 1972. The remaining titles:

Wooden Heart – Plantation Rock – The Lady Loves Me – Swing Down Sweet Chariot – That's All Right – Are You Lonesome Tonight? – Reconsider Baby – I'll Remember you.

Playing time is about 34 minutes. The album is endorsed "For collectors everywhere" and that would be a fair description. (W.N.W.)

Micronews

Cabinet and keyboard for homebrew computers

The latest in Rod Irving's expanding range of computer products is a stylish case and detached keyboard for single-board computers.

Moulded in white impact-resistant plastic, the two part case measures 45 x 40 x 11cm, with two cut-outs in the front to suit 13cm half-height minifloppy disk drives.

The separate keyboard is 45cm wide and 19cm deep. Height at the rear is 4cm, sloping to 2.5cm at the front, although two wire legs at the rear can be snapped down to increase the slope of the typing surface. The keyboard is serially encoded and connected by a generous length of coiled cable to a DIN socket at the side of the cabinet. A small circuit board in the cabinet converts the serial output of the keyboard to a parallel output, available via a length of ribbon cable and a dual-in-line plug.

The keyboard has 87 keys, including eight special function keys on the left and a numeric keypad on the right. It is modelled after the keyboard of the IBM PC, right down to the extra backslash key between the "Z" and the left-hand shift key (a real bugbear for touch typists, and probably the most criticised point of the PC).

The keys are white with black legends, and carry labels for single key entry of Basic statements on their front surface. Two keys on either side of the space-bar have holes for miniature LEDs, although these are not installed. These are the latching "shift-lock" key and another marked "power", although it seems an unlikely place for an off/on switch. The key action is smooth and positive and well up to professional standards.

The case is divided into top and bottom sections held together by plastic pillars and sockets tapped to take screws. Inside is the serial to parallel keyboard encoder already mentioned, mounted under a metal shelf which serves to secure the disk drives.

At the rear is an RCA socket for video and two miniature audio sockets for a cassette interface. All sockets are pre-wired, and other metal plates, wires and mounting hardware are supplied for the disk drive mountings, power connection, and miscellaneous connections. Stick-on labels of metallised paper are provided for the video and cassette connectors.

Apparently the case is designed to take single-board computers such as the "Big Board II", and for the price it would be an excellent complement to any home-brew computer system. Cost is $299 including sales tax, and it is available from Rod Irving Electronics, 425 High Street, Northcote, Vic or 48-50 A'Beckett St, Melbourne. There is also a mail order "hotline" on (03) 481 1436.

IBM to offer Unix for PC

In a significant move for the microcomputer industry, IBM has announced that it will offer Unix for the IBM PC in an operating system known as "Personal Computer Interactive Executive", or PC/IX.

Features of the PC/IX include a full-screen editor, standard Unix functions including networking, command languages, file monitoring, text processing and programming development tools, a C compiler and multi-tasking capabilities. It runs on the IBM PC-XT with at least 256K of memory and a 10 megabyte hard disk drive.

Unix originated at Bell Labs, the research arm of AT&T, and has an extensive following in universities throughout the world. Various versions are already available for the PC but IBM's announcement of an "official" version is expected to appeal to large users and technical groups.

Koala TouchTablet simplifies graphics input

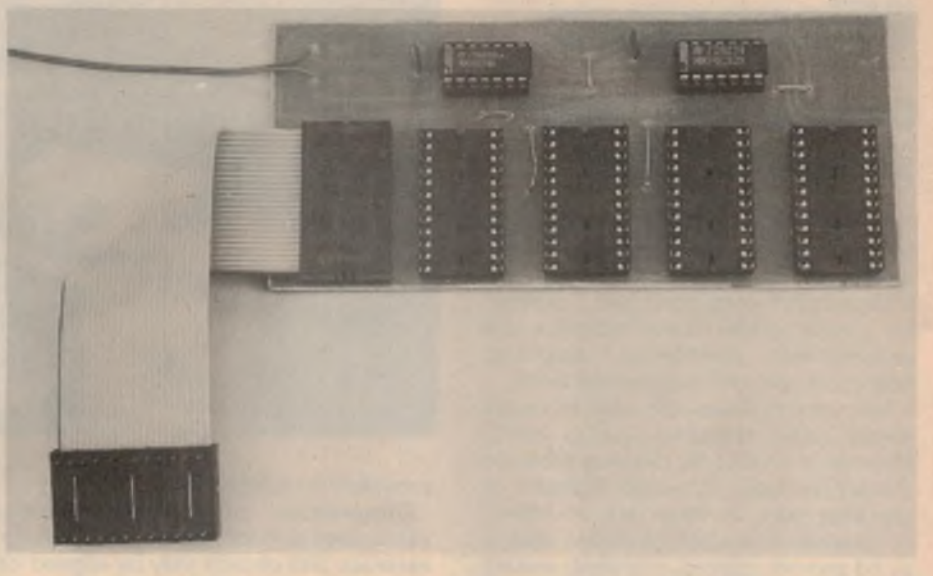
The Koala "TouchTablet" is a pressure sensitive pad which converts the movement of a stylus or pointing finger to X and Y co-ordinates which can be read by a computer. Versions are available for the Apple II, Commodore 64 and VIC 20, IBM PC and Atari personal computers.

The Koala Pad has an active area of 120mm square in an attractively styled white plastic case. A stylus is provided and is simply a blunt pointed plastic rod. Pens and biros are not recommended for use with the pad as sharp points may mar the surface of the pad. Two large buttons above the pad active area are used to select drawing or movement without drawing on the screen.

We were attracted to the Koala pad because it appears to solve a common problem with computer graphics – the initial input of designs – at a fraction of the price of professional quality digitising tablets. We tried the version available for the Commodore 64, in conjunction with a ROM cartridge containing a "KoalaPainter" program.

The KoalaPad plugs straight into the first joystick port of the Commodore 64. With the software cartridge in place the system comes up with a "sign-on" routine with a koala bear nestled among gum trees. Following sign-on, a graphic

Low cost MicroBee EPROM expander



For those who want the convenience of using two sets of Microbee EPROM software without the expense of the larger Avtek "Multiprom" board, Avtek Electronics also has a smaller and less expensive add-on, the XM-1 (for early model MicroBees) and the XM-2 (for the MicroBee IC).

The board takes two sets of EPROMs, such as Wordbee and Edasm, and allows the user to choose between them by simple commands from the keyboard. Four EPROM sockets, a 24-pin DIP connector and switching logic are mounted on the board, which connects by a short length of cable and a second DIP connector to the original EPROM sockets inside the MicroBee.

Apart from plugging in the chips and connector only two solder connections need to be made to install the board. The XM-1 board suits early model MicroBees and those using 2532 type EPROMs (with serial numbers starting with 8). The XM-2 model suits the MicroBee IC and also responds to PAK1 and PAK2 commands. Cost is $19.95 for the XM-1 and $16.95 for the XM-2.

For further information contact Avtek Electronics Pty Ltd, 119 York St, Sydney, 2000, (02) 267 8777 or PO Box Q302, Queen Victoria Building, Sydney, NSW, 2000.

menu of options appears on the screen.

Options available include drawing with "brushes" of various sizes and shapes, lines, boxes, circles and solid shapes, a "Fill" command, "Copy" and a command to allow pictures to be stored and read from disk. Selecting an option is a matter of moving a flashing arrow on the screen, using the bit pad and stylus, and then pressing on the surface when the arrow is positioned over the required command.

One feature we particularly liked was the ZOOM command, which allows a selected area of the screen to be magnified by a factor of about 16. The magnified area can then be worked on with whatever command is in current use, and all changes made on a pixel by pixel basis will be transferred automatically to the normal size drawing.

All commands can be active in one of 16 colours or one of a range of patterns. These patterns alternate pixels of two different colours to create tones and apparent textures on the screen. Two independent screens are available for drawing and parts of one picture can be copied into the alternate screen at any time.

The KoalaPad is excellent for freehand doodling and the construction of geometric shapes. Considerable practice is required, however, before the bit pad stylus can be manipulated with total confidence. Part of the problem is the small active area of the pad, approximately one-quarter the size of a video monitor display. All movements on the pad are amplified by a factor of four on the screen. Some other minor limitations of colour placement are inherent in the Commodore 64, but these only appear in complex drawings.

"KoalaPainter" uses the bit pad well and is an excellent introduction to "computer art", but it will not be the end of the KoalaPad's capabilities. Without any software, the KoalaPad appears to the Commodore 64 as a joystick, and can be used with any program in exactly the same way as the Commodore joysticks. Applications in music, games and data input come to mind immediately, and we suspect that the KoalaPad will have a long and useful life with any computer enthusiast.

Readers thinking, by the way, that the KoalaPad must be an Australian invention will be surprised to learn that it is in fact manufactured by Koala Technologies Corporation, California, USA.

Price of the KoalaPad is $149.95 accompanied by "KoalaPainter" software on disk or $169.95 for the pad with ROM cartridge software. Our review model was kindly supplied by OziSoft Pty Ltd, GPO Box 4475, Sydney, NSW, 2001, who distribute a wide range of software for the VIC 20, Commodore 64 and Sinclair Spectrum computers at their sales office, Suite 33/8-24 Kippax St, Surry Hills, NSW.

Micronews

Computer Aided Design software for micros

AUTOCAD is a two dimensional computer-aided design and drafting system which runs on a variety of low-cost personal computers and is suitable for a wide variety of applications in the architectural, mechanical, electrical, hydraulics and civil engineering fields.

The system allows the user to create menus using text files and to define libraries of shapes by drawing them on the screen using a mouse, lightpen or digitising pad. A large set of editing commands allows screen design objects to be moved, copied, modified, erased, rotated or scaled in any combination, while repetitive patterns are created automatically. A zoom facility is provided for added detail.

Dimensions of all objects are maintained as floating point numbers for accuracy and objects may be aligned or forced to conform to a grid displayed on the screen. Up to 127 layers and colours may be used, allowing selective viewing or the plotting of drawings as if on transparent overlays. Plotter output is available with a resolution of 0.025mm.

Further information on the AUTOCAD system is available from MCS Microcomputer Systems, 502 Miller St, Cammeray, NSW. Phone (02) 923 1137.

G-Pascal for the Commodore 64

An advance new programming language for the Commodore 64 is now available from Gambit Games of Victoria. "G-Pascal" is a structured Pascal compiler with additional features to support the graphics, sprites, music and internal timer of the Commodore 64 in games programs.

In all, G-Pascal contains 76 separate extensions to the Pascal language to support the unique features of the Commodore 64 as well as major Pascal constructs.

The language compiler is self-contained so that once it is loaded from disk or cassette it can be used to edit, compile and test programs continuously without further disk or cassette access. A built-in text editor with "find and replace" capability aids program entry and correction, and compilation speed is quoted as 6,000 lines per minute.

Programs can be saved and retrieved from disk or cassette and are stored in a compressed format which allows large programs to be used without adding excessively to storage requirements or loading time. G-Pascal itself occupies 16K of RAM, leaving considerable space for programs and graphics effects.

An 80-page user manual is supplied with the compiler, including a step-by-step guide to getting started and detailed instructions on all graphics and sound effects commands as well as error messages.

Further information is available from Gambit Games, PO Box 124, Ivanhoe, Vic 3079. Phone (03) 497 1283.

Imagineering special offer to training seminars

Imagineering has announced details of an "education licence agreement" which will allow microcomputer dealers and professional organisations to obtain software for use in training seminars at significantly discounted prices.

The special price allows discounts of up to 90% on software and peripherals for use in training. Software from Visicorp and Micropro are included as complete packages while other Imagineering products are available at up to 50% off retail.

An application form must be completed for each training course, giving complete details of the course, the product being taught and the name of the instructor etc.

Further information is available from Mr Phil Woolley, Marketing Manager, Imagineering, 759 Harris Street, Ultimo, NSW (02) 212 1411 or in New Zealand from Mr Paul Dixon, Imagineering, 1-3 Arawa Street, Auckland (09) 39 6266.

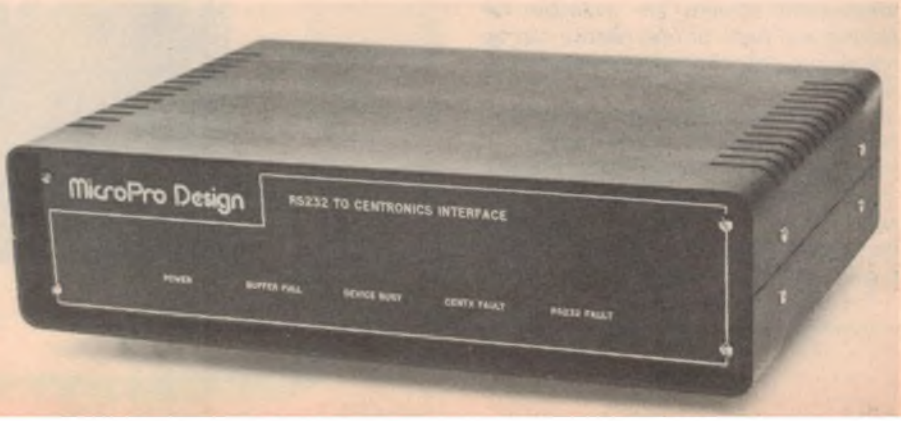
Interface problems solved

MicroPro Design has announced the release of a range of communications interfaces to suit all popular microcomputers and covering the configurations most often required when attempting to connect incompatible pieces of computer equipment.

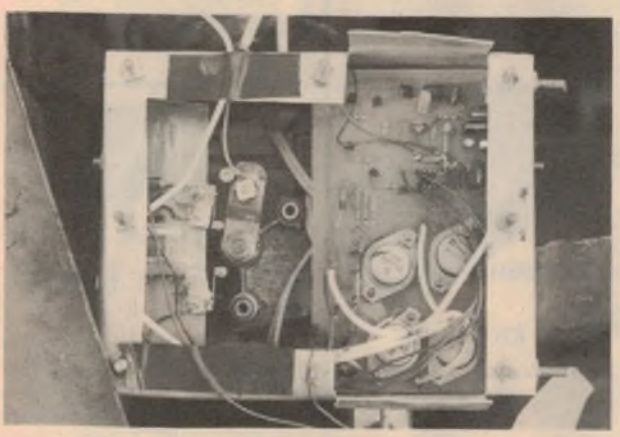
Most of the interfaces are microprocessor-based with LED indication of settings and switch selectable operating modes. Custom variations are also possible for particular applications.

The range includes IEEE488 to RS232, Centronics to RS232, RS232 to Centronics, RS232 to RS232 buffer and RS232 to 20mA current loop converters, all housed in robust aluminium enclosures and powered from the mains.

Further information is available from MicroPro Design, PO Box 153, North Sydney, NSW, 2060. Phone (02) 438 1055.



Next month in Electronics Australia*



Cruise control for cars

Commercial cruise controls are available but usually cost around $200. This do-it-yourself unit can be built for less than half that figure (about $60) and uses readily available parts.

Heat controllers

These mains control units are designed for use with electric blankets, vertical grillers, radiators, and in other heat control applications. There are two versions: one featuring manual control and the other thermatically controlled.

Yamaha CD-X1 compact disc players

Retailing for just $599, Yamaha's CD-X1 compact disc player is now the lowest priced model on the market. June "Electronics Australia" features a full review of this interesting newcomer.

Function Generator enhancement

Did you build the Function Generator described in April 1982? This simple add-on circuit lets it operate as a digital frequency meter and improves the linearity of the coarse frequency control.

*Although these articles have been prepared for publication, circumstances may change the final content. However, we will make every attempt to include the articles featured here.

ROD IRVING ELECTRONICS

425 HIGH ST, NORTHCOTE 3070 VIC PHONE (03) 489 8866

KITS—KITS—KITS—KITS—KITS—KITS—KITS—KITS—KITS—KITS—KITS—KITS—KITS—KITS

PARABOLIC MICROPHONE $15

Build a low cost parabola, along with a high gain headphone amplifier to help when listening to those natural activities such as babbling brooks, singing birds or perhaps even more sinister noises. The current cost of components for this project is around $15 including sales tax, but not the cost of batteries or headphones.

EA NOVEMBER '83

TV PATTERN GENERATOR $25

Make sure your TV is up to the mark with this low cost Pattern Generator which uses just seven ICs and gives three patterns: Dot, crosshatch and blank raster. The current cost of parts for this project is approximately $25 which includes sales tax but not the cost of a modulator or 9V mains plugpack.

EA NOVEMBER '83

ETI-268 NICAD FLOAT CHARGER

$9.00 ETI MARCH '83

Keep your NiCad batteries in tip-top condition with this cheap, simple charger.

ETI-1512 ELECTRIC FENCE TESTER

$24.50

ETI FEB '83

No more checking the 'feel' of a fence with a blade of grass (and maybe ending on your . . .). This project tells you how much your fence energiser delivers and can be used for fault-finding oh a fence.

ETI-1516 MODEL ENGINE IGNITION SYSTEM $41.50

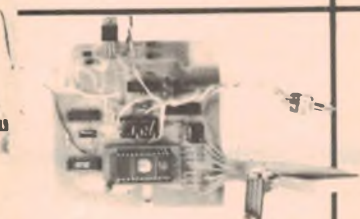
ETI JUNE '83

Get sure starts every time and no more glow plug burnouts on your model engines.

ETI MAY '83

ETI-163 LAB SUPPLY $175

Fully variable 0–40 V current limited 0–5 A supply with both voltage and current metering (two ranges: 0–0.5 A/0–5 A). This employs a conventional series-pass regulator, not a switchmode type with its attendant problems, but dissipation is reduced by a unique relay switching system switching between taps on the transformer secondary.



ETI-668 MICROBEE EPROM PROGRAMMER $47.50

ETI FEB '83

Simple, low cost programmer for the MicroBee can program 2716s, 2732s and 2764s.

ETI-153 TEMP PROBE

$19.95

ETI JUNE '83

Can measure temperature from −50°C to +150°C. It simply plugs into your multimeter—great for digital multimeters. Accuracy of 0.1°C, resolution of 0.1°C.

ETI MAY '83

ETI-323 HEADLIGHT DELAY UNIT $17.50

Park your car and turn off the lights. Can't see where you're going? Press the button and the headlights come on to light your way, switching off automatically after 50 seconds. This is a simple, easy to build, low cost project.

ETI APRIL '83

ETI-1515 DRILL/BLENDER SPEED CONTROLLER $27.50

This project provides a full range of speed control for appliances having 'universal' ac motors. Once the speed is set, the motor will maintain that speed from no-load to heavy-load. Great for drills, blenders, grinders, etc.

ETI-162 30 V/1 A FULLY PROTECTED POWER SUPPLY $47.50

ETI DEC '83

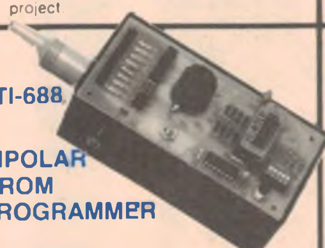
The last power supply we did was the phenomenally popular ETI-131. This low cost supply features full protection, output variation from 0 V to 30 V and selectable current limit. Both voltage and current metering is provided.

ETI-654 APPLE II ANALOGUE/DIGITAL INTERFACE

$159.00 ETI MARCH '83

This project will give your Apple a set of 8-bit digital inputs and outputs plus one analogue input and one analogue output. Applications include: driving a robot, recording science experiment results, etc (digital only shown).

ETI-688 BIPOLAR PROM PROGRAMMER



$47.50 ETI JUNE '83

Every digital workshop should have one! Can be used to program the popular fusible-link PROMs like the 74S188/288, 82S23 and 82S123 etc.

ETI-461 GENERAL PURPOSE BALANCED INPUT PREAMP $20.00

ETI DEC '83

This project can be used as a balanced mic amp with low impedance input, a low or high impedance input differential amplifier or a balanced input instrumentation amplifier.

ETI-164 ZENER TESTER

$9.50 ETI MAY '83

A simple, low cost add-on for your multimeter. This checks zeners and reads out the zener voltage directly on your multimeter. It can also check LEDs and ordinary diodes.

ETI-334 AUTO TESTER

$17.00 ETI JAN '83

Just the thing to keep in the glovebox or toolkit to find those nasty electrical bugaboos that occur at awkward times. Simple to build, simple to use.

ETI-335 PUSHBUTTON-PROGRAMMABLE WIPER CONTROLLER

$28.50 ETI MARCH '83

No more fiddling with knobs and not getting the delay between wipes that you want—this windscreen wiper controller is simply programmed with two pushbuttons to provide the wiping delay you need.

ETI APRIL '83

ETI-733 RADIOTELETYPE CONVERTER FOR THE MICROBEE $20.00

Have your computer print the latest news from the internation shortwave news service. Just hook up this project between your shortwave receiver's audio output and the MicroBee's parallel port. A simple bit of software does the decoding. Can be hooked up to other computers too.

48-50 A'BECKETT ST, MELBOURNE 3000 VIC PHONE (03) 347 9251

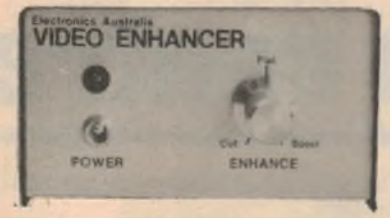
Mail Order Delivery Instructions: Minimum Pack and Post $3.00 for Australia Post. Please allow extra for bigger orders and Certified, Airmail or Registered Post. Minimum order is $5.00. Please address orders to Mail Order Department, PO BOX 235, NORTHCOTE, 3070, VICTORIA. PHONE (03) 481 1436.

ROD IRVING ELECTRONICS

425 HIGH ST, NORTHCOTE 3070 VIC PHONE (03) 489 8866

100's SOLD

VIDEO ENHANCER $35



Like tone controls in a hifi amplifier, touch up the signal with this Video Enhancer

EA OCTOBER 83

1000's SOLD

TRANSISTOR TESTER $15

Have you ever desoldered a suspect transistor, only to find that it checks OK? Troubleshooting exercises are often hindered by this type of false alarm, but many of them could be avoided with an "in-circuit" component tester such as the EA Handy Tester.

EA SEPTEMBER 83

CAR ALARM $29.00

This Car Alarm uses the battery earth strap as a sensor to detect when a "courtesy" light or other electrical load occurs when a thief enters a vehicle. The circuitry is simple and immune from false triggering problems. **ETI July 81**

VIDEO AMPLIFIER $15

EA AUG 83

Bothered by smeary colours, signal beats and RF interference on your computer display? Throw away that cheap and nasty RF modulator and use a direct video connection instead. It's much better.
The Video Amplifier features adjustable gain and provides both normal and inverted outputs. Power is derived from a 12V DC plugpack supply. **INCLUDES JIFFY BAG**

LOW OHMS METER $34.50

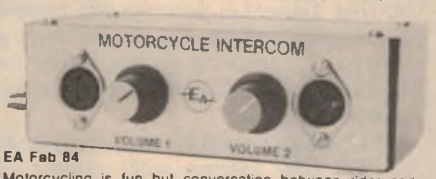
How many times have you cursed your Multimeter when you had to measure a low-value resistance. Well alas, with the "Low Ohms Meter" you can solve those old problems and in fact measure resistance from 100 Ohms down to 0.005 Ohms **ETI 158 November 81**

NAIL FINDER $10

Essential for the home handyman the Nail Finder will help locate timber studs behind Gyprock or plasterboard wall surfaces as well as locating pipes and wiring buried in walls

EA OCTOBER 83

MOTORCYCLE INTERCOM $40



EA Feb 84

Motorcycling is fun but conversation between rider and passenger is usually just not possible. Build this intercom and you can converse with your passenger at any time while you are on the move.

SLIDE CROSS FADER $85.00

PHONE MINDER $25

EA Feb 84

Dubbed the Phone Minder, this handy gadget functions as both a bell extender and paging unit, or can perform either function separately.

±12V RAILS FOR LAB POWER SUPPLY

EA July 1983

$13

An inexpensive addition to the 50V 5A Lab Power Supply which should prove its worth many times over. It provides additonal fixed ±12V outputs for lower power applications.

Driveway Sentry

$32

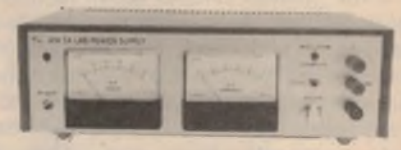
Activated by your car's headlights, the "Driveway Sentry" will turn on a driveway or garage light so that you can make a safe exit from your car on the darkest of nights. At the end of five minutes, it will automatically turn the light off again.

SPEED SENTRY $21

EA OCTOBER 83

Paying speeding fines can be a painful business. Build this Speed Sentry and avoid further pains in the wallet.

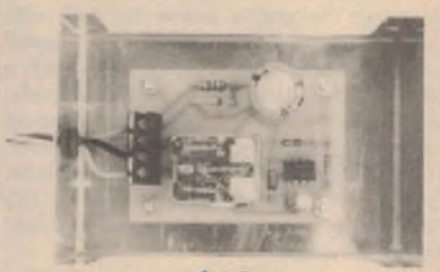
50V 5A LABORATORY POWER SUPPLY



New switchmode supply can deliver anywhere from three to 50V DC and currents of 5A at 35V or lower. Highly efficient design.

EA May, June 1983 **$140.00**

CAR IGNITION KILLER



$13 **EA Feb 84**

Most car burglar alarms are easily circumvented, but not our cunning "Ignition Killer". This sneaky antitheft device uses a 555 timer to place an intermittent short circuit across the points. Until disabled by its hidden switch the circuit effectively makes the car undriveable — a sure deterrent to thieves!

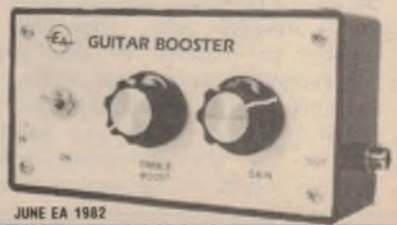
Electric fence $19.50

Check our prices

SEPTEMBER EA 1982

Mains or battery powered, this electric fence controller is both inexpensive and versatile. Based on an automotive ignition coil, it should prove an adequate deterrent to all manner of livestock. Additionally, its operation conforms to the relevant clauses of Australian Standard 3129.

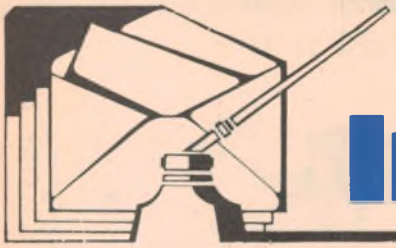
EA GUITAR BOOSTER $17.50



JUNE EA 1982

48-50 A'BECKETT ST, MELBOURNE 3000 VIC **PHONE (03) 347 9251**

Mail Order Delivery Instructions: Minimum Pack and Post $3.00 for Australia Post. Please allow extra for bigger orders and Certified, Airmail or Registered Post. Minimum order is $5.00. Please address orders to Mail Order Department, PO Box 235, NORTHCOTE, 3070, VICTORIA. PHONE (03) 481 1436



Information centre

IGNITION KILLER: I have a 1983 Ford Laser with breakerless ignition. Will the "killer" in its present form not damage the car system when connected to the coil negative. (W.F., Canterbury, NSW)

● If the ignition killer is active for only short periods it is unlikely that any damage would result to the ignition system. However, if a thief abandons the car with the ignition system "hot-wired" it is possible that the coil could overheat and eventually burn out. This is preferable to having the car stolen but if you also want to prevent damage to the coil we suggest installing a 33Ω/5W resistor in series with the relay contacts.

The problem of heavy current flowing through the coil is worse for cars with solid state ignition fitted as original equipment because the coil has such a low DC resistance. It is highly unlikely, by the way, that the solid state module would be damaged by the ignition killer.

IGNITION KILLER: The ignition killer project is a great idea! However, I've thought of a couple of things that could make it better.

Firstly, the "disable" switch should be taken from "reset" (pin 4) of the 555. This should be tied high via a pullup resistor so that the unit is permanently enabled, but when taken low via a switch from pin 4 to earth, the unit is disabled. This has a number of advantages over the original placement:

1. A burglar hopefully snipping this wire would only permanently enable the device (rather than disable with the original design).
2. It reduces the switch wires to one, as the other side is connected to a convenient earth under the dash.

Secondly, to any thief with half a brain, a couple of extra wires across the H/T coil leading to a box is going to look a bit suspicious – snip – no more ignition killer. This might not look so bad if the box was marked "electronic ignition" of similar.

Another possibility is to make the unit very small and mount it inside the H/T coil – there's enough room if you don't use a PCB and use a compact relay. This would only leave one extra wire (enable) to give an indication of an anti-theft system.

However, this approach is probably beyond the scope of most of your readers, not to mention a number of technical difficulties – like the H/T coil being full of transformer oil which could lead to premature component failure if not properly sealed (how well does a relay full of oil work? I suppose it would solve the problem of relay click attracting the thief's attention!). (D.C., Rosanna, Vic.)

● We agree that, at first sight, using the reset pin of the 555 as the enable/disable control is attractive. However, in the electrically noisy environment of a car, using the reset pin with a long wire to the on/off switch is asking for trouble. You would be likely to have intermittent false triggering.

It is far better to have the 555 completely disabled by removing power via the on/off switch. At least that way there can be no false tripping of the relay and no likelihood of stalling in the wrong place.

How to dim fluorescent lights

AUTODIM: I have built two of the Autodim units which you published in January 1981. The reason for this type of unit is that I have a theatrette and I felt this would be the answer to house lights and curtain lights.

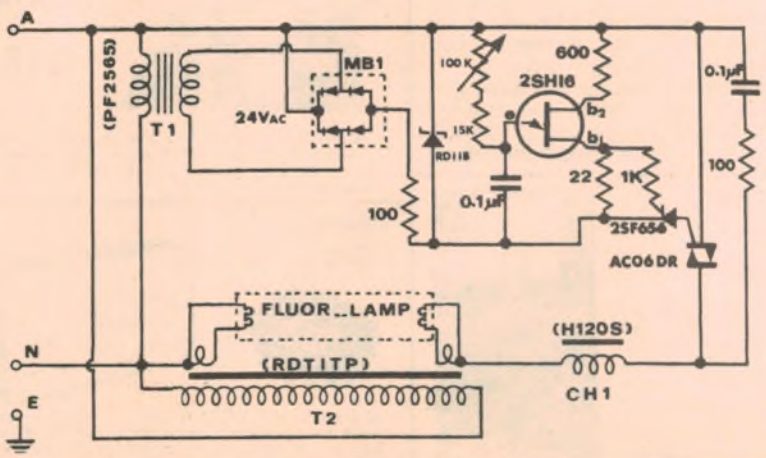
The house lights being incandescent, I have no trouble at all, but the curtain lighting uses fluorescent tubes and the problem here is when the light reaches about half-brilliance it starts to pulse so I am unable to bring it up to full on, without severe pulsing.

I have previously had the lights on manual dimmers and they worked OK, so the question is do you know of a modification which will cure this problem? (K.T., Ashwood, Vic.)

● As a general rule, light dimmer circuits using Triacs are not suitable for fluorescent lights. There are a number of reasons for this. First, fluorescent lights present a largely inductive load to the dimmer circuits which most are unable to handle because of the inevitable spike voltages which are generated when the Triac turns off at the end of each mains half-cycle.

At best, these spike voltages may cause the lamp to flash on and off in an uncontrollable fashion, as you have found. At worst, the spike voltages may destroy the Triac. The way around the problem is by using a commutating network across the Triac. This consists of a series RC network which is selected to suit the load driven by the Triac and it reduces the spike voltage to a safe value.

The other problem associated with dimmer circuits is that fluorescent lights will not start reliably at low settings of the dimmer. The reason for this is that the energising voltage for the tube heaters is inadequate for the required electron emission and if a starter circuit is used, the initial tube current will be too low to give the required tube firing voltage.



Only one wire need go directly to the coil negative and even if both wires go directly to the coil it should be possible to rout them behind the coil so that they are well nigh invisible. And if the thief does find the wires to the ignition coil you would be able to console yourself that he was really determined to pinch your vehicle. Even the best alarm will not stop a really determined thief. Unfortunately.

As far as the suggestion of building the ignition killer inside the coil is concerned, it is just not on. The above remarks about electrical noise apply even more so here. Not to mention the physical problems of coil flashover to foreign components mounted inside the cap!

FLOW/ECONOMY METER: March 1983 had a project on a fuel flow/economy meter for motor vehicles. This project used a fuel sensor which could be purchased from Dick Smith and I have purchased one. I want to make a fuel flow meter for my boat and for this purpose a lot of the features on your project are superfluous.

What is required is simply a circuit to provide a digital readout of the signal from the fuel flow sensor in litres per hour or gallons per hour. Can you suggest how your original circuit could be changed to perform this simple function, or is there someone I can contact to get such a circuit design. (P.K., Gold Coast, Qld.)

The only way to reliably dim fluorescent lights is to rewire the fittings so the heaters are permanently energised from a constant voltage, ie, not affected by the dimmer operation. The accompanying circuit which is reprinted from our September 1970 issue (and originally from the STC "Components Review") shows the required circuit arrangement. The circuit shown is for a 20W tube but the principle could be adapted to any tube rating.

In addition, more than one fluorescent tube may be controlled provided there is a separate ballast inductor (CH1) and heater transformer (T2) for each tube. The AC06DR Triac may be substituted with any 6-amp 400V type such as the SC141D from GE. The 2SF656 may be replaced with a C103 or C106 and the 2SH16 unijunction transistor replaced with a 2N2646.

Transformer T2 (Ferguson RDT1TP) is the tube heater transformer and has two separate windings which deliver between 3.7 and 3.8 volts with sufficient current for any tube rated between 20 and 65 watts.

Electronics Australia Reader Service

"Electronics Australia" provides the following services:

PHOTOSTAT COPIES: $3 per project, or $6 where a project spreads over multiple issues (price includes postage). Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries. We reserve the right to supply complete back issues instead of photostats, where these are available.

CHASSIS DIAGRAMS: For the few projects which require a custom metal chassis (as distinct from standard cases) dyeline plans showing dimensions are normally available. $3 including postage.

PC BOARD PATTERNS: High contrast, actual size transparencies: $3, including postage. Please specify positive or negative.

PROJECT QUERIES: Members of our technical staff are not normally available to discuss individual projects, either in person at our office, or by telephone.

REPLIES BY POST: Limited to advice concerning projects published within the last three years. Charge $3. We cannot provide lengthy answers, undertake special research, or discuss design changes. Nor can we provide any information on commercial equipment.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" or submitted without fee may be answered in the "Information Centre" pages, at the discretion of the Editor.

COMPONENTS: We do not sell electronic components. Prices and specifications should be sought from advertisers or agents.

BACK ISSUES: Available only until our stocks are exhausted. Within six months of publication, face value plus 30c for post and packing for each issue. Seven months and older, $3 (includes post and packing and storage fee).

REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia". Where the exact charge may be in doubt, we recommend submitting an open cheque endorsed with a suitable limitation.

ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Chippendale, 2008.

● It is not possible to modify our March 1983 design so that it has a digital readout instead of an analog display. You would have to discard the circuit completely and start again. The approach you need is similar to that used in Circuit & Design Ideas for May 1983. To get a reading in litres per hour you would have to use the fuel flow sensor to clock the 74C926 counter (pin 12) and provide a fixed timebase for latch and reset signals.

However, we are not sure that a digital display would be as effective as the analog unit we designed because, inevitably, there would be fluctuations in the reading. This is in spite of the fact that marine engines use constant throttle settings for long periods.

LOG PERIODICS: I am a beginner hobbyist with electronics and would like to build an antenna from the article by M. Taylor, EA March 1984. I was hoping to get the best reception value for now and future years and so figured designs 1 & 5 on a pole together would make sense. Is that feasible? If so, do I simply wire their harnesses in parallel coupling to a 75Ω coax?

Also, could you expand the explanation of the "stub termination" and the fitting "feeder termination length" as, for some reason, I am unable to clearly understand the notes on these? (D.S., Rozelle, NSW.)

● You have not indicated what you want the antennas for but we assume that you are mainly concerned with TV reception. In that case, design number one should be adequate for your purpose since you are an inner city dweller.

On the other hand, if you really do wish to feed both these antennas into the one cable, it would be necessary to combine the two signals by means of a suitable diplexer. In essence, this is a combination of a low pass and a high pass filter which stops the antennas from loading each other.

Note also that if you did install both antennas on the same pole you would have to space them about three metres apart to achieve the best performance from each. That would result in a fairly long pole.

As described in the fourth article in our series "How to obtain better TV reception" in October 1983, the stub on a log periodic antenna is merely a length of short circuited feeder (coax cable) or a wire loop (or can be aluminium tubing) of a particular length which is included to match the antenna load. What the stub does is to balance out the reactance of the antenna over a fairly narrow range of frequencies and thereby make the antenna a more resistive source.

As far as the "feeder termination length" is concerned, it is the effective length of the stub. For a stub of 833mm, as specified for design one, you will need twice that length of aluminium wire or strip. Note that the stub can be folded back along the underside of the boom.

LOG PERIODIC DIPOLES Allow me to thank you for the series "How to obtain better TV reception". As an "ultra-fringe" viewer, they have been much appreciated. I had great fun playing with the computer program and converting it to run on a Microbee. The point of all the effort was to design a high gain antenna for channel 11. I am now uncertain on two points, largely to do with the mechanics.

On page 79 referring to dipole length, does this mean that the gap is included within the length or that the harness gap

is excluded? In either case, I assume that there are gap dimensions that it would pay not to exceed.

In referring to the feeder termination length does this run around the corner (a) or not include the corner (b) as seems more likely? Again I thank you for a most interesting magazine. (J.L., Ravensthorpe, WA.)

● As far as the dipole length is concerned it does include the harness gap. Depending on whether you use standard antenna hardware or make your own the harness gap can be around 70mm or so. The "feeder termination length" is the length of the stub which means that the length of aluminium strip required is twice that value.

Incidentally, if you require a high gain antenna only for channel 11 it would be wise to consider the single channel Yagi designs presented in part five of the series, in the November 1983 issue. These antennas would be smaller than a log periodic array of similar gain and somewhat easier to make.

MUSICOLOUR IV: I have built the Musicolour IV for disco purposes and also to colour my room. Since I built it, people have asked me to do something similar for operation in a car and I think something can be done using the Musicolour IV circuit procedure. We can cancel the cost of the transformer and the rectifier diodes. (A.C., Bossley Park, NSW.)

● It would be no simple task to adapt the Musicolour circuit to use in a car, running from the 12V battery supply. For a start, the Triacs in the Musicolour run from AC and being a regenerative switching device, cannot be made to work on DC. By regenerative we mean that once the device is turned on it cannot be turned off unless the current drops to zero of its own accord or the supply voltage is reversed.

If a low voltage Musicolour device was designed it would have to use power transistors to drive the lamps. And probably heat dissipation in the transistors would be a problem so it would be necessary to use switchmode techniques to control the power to the lamps.

Frankly, we would be loathe to promote the use of a Musicolour device in cars anyhow. They might be permissible in boats, caravans and in the back of recreation vehicles but even there we are not convinced there would be much use for it. Unless we get some indication that readers are keen on the idea that is one that we will give a miss.

PORTABLE COMPUTER: I am going to buy a VZ200 soon and would really like a portable computer but I can not afford one. So I am writing to ask if you would publish a project which was fairly simple which has these features: LCD display as shown on the bottom of page 106 in your January issue, EPROM programmer, EPROM banking card, RS232 interface 2k RAM up-grade and a battery pack to power it and the computer. (M.C., Parkside, SA.)

● Sorry, but we cannot do it. If you wait a few years we are sure that such a computer will be cheap. It is not at the moment.

Notes & Errata

IGNITION KILLER (February 1984, File No 3/AU/38): There is a possibility of damage to the ignition coil in the event of the "killer" circuit being operated for an extended period. To prevent this, connect a 33Ω/5W resistor in series with the relay contacts.

HOW TO OBTAIN BETTER TV RECEPTION Pt 6 (March 1984, File No 6/MS/14): The parameter alpha is incorrectly defined. It should be half the angle of the virtual apex of the array. Also, in the formula for the relative length of the antenna, the divisor term should be Bs and not Bx. Note also the dipole length in each case includes the spacing between the respective harness connection points.

50 and 25 years ago...

"Electronics Australia" is one of the longest running technical publications in the world. We started as "Wireless Weekly" in August 1922 and became "Radio and Hobbies in Australia" in April 1939. The title was changed to "Radio, Television and Hobbies" in February 1955 and finally, to "Electronics Australia" in April 1965. Below we feature some itmes from past issues.

May, 1934

Pictures by radio: The latest apparatus for the transmission of pictures by wireless (which could not be conveniently and economically made in Australia) has now reached here, and AWA engineers are now engaged in adapting and modifying the equipment for installation in the Beam Service. When this is completed it will be possible to transmit photographs, fingerprints, handwriting, cheques, drawings, and other documents across the world.

The first picture transmission was carried out by Mr Fisk between Australia and London as early as 1929, but this was of a purely experimental nature.

Phasing out the carbon mike: It is said that the new BBC ribbon microphone, developed on the moving coil principle by a young research worker called Alexander, may become the BBC standard type. The BBC now has a "Microphone Research and Studio Technical Committee," which endeavours to improve transmissions; the committee is said to be thinking of changing from the Reiss microphone to the Western Electric type, especially for outside broadcasts.

Early radio-teletype: The American Government is testing tele-typewriters, or typewriters operated by wireless, on the American Federal Airway between Baltimore and Washington. If the tests are successful the Government hopes to effect a substantial saving in land-wire costs. In this present test the tele-typewriters will be used for weather forecasts.

The rating game, 1934: A Dr Nevil Hopkins, of New York, calculates that most listeners use mains sets, and he says that a knob on all receivers, joined to the mains, could be fitted up so that when an announcer wished to know how many people were listening to his program he could just ask all listeners to press the knob on their sets; this would make a slight change in the current drain from the power-house, and the power-house, by measuring the change, could estimate fairly accurately how many people had pressed the button.

Who dun it? The BBC has begun a new "chain serial" story for Friday nights. One well-known writer begins a mystery story, and next week another well-known writer takes it up, etc. This series is to be opened up by Agatha Christie, and then it will be taken up by Dorothy L. Sayers, Compton Mackenzie, and Walter de la Mare, among others.

Line out: Geneva police are trying to find out who cut the lines carrying the Austria versus Switzerland football description on March 25. The game was the biggest of the season; there were 25,000 spectators, and the match was half-way through when someone cut the line. The police feel that political feeling was responsible.

May, 1959

Soon, a man in orbit: The American National Aeronautics and Space Administration Research Centre at Langley Field VA has made extensive tests on the design for a "Mercury" capsule intended for outer space.

Prototypes have been tested for lift, drag and static stability using a specially developed wind tunnel, to evolve the best shape for an orbital vehicle.

In the case of an abortive launching, a rocket on top of the capsule will be fired to ensure elevation to a safe altitude so that it can return to earth by means of parachutes for recovery and the safety of its occupants and contents.

Further experiments have been conducted to observe water landing conditions if those should be encountered.

The capsule, with its protective covering against heat and radiation, will carry a variety of instruments, communications equipment, pressurised living quarters and survival equipment.

Hovercraft debut: Britain's fantastic "sea saucer," the forerunner of giant flying ships which will revolutionise ocean travel by skimming at high speed a few feet above the waves, is nearly ready for flight.

The prototype, a gleaming 25ft oval of polished aluminium, will have its first hovering tests next month.

If all goes well it will be launched on Southampton Water early in June, according to the "Daily Mail."

The giant flying-ship – officially called a Hovercraft – is being developed by Saunders Roe, under a contract from a new firm set up to exploit the invention.

The firm, Hovercraft Development Company Limited, and Saunders Roe are being backed by the National Research Development Corporation.

One of the first uses of the Hovercraft might be as a car ferry.

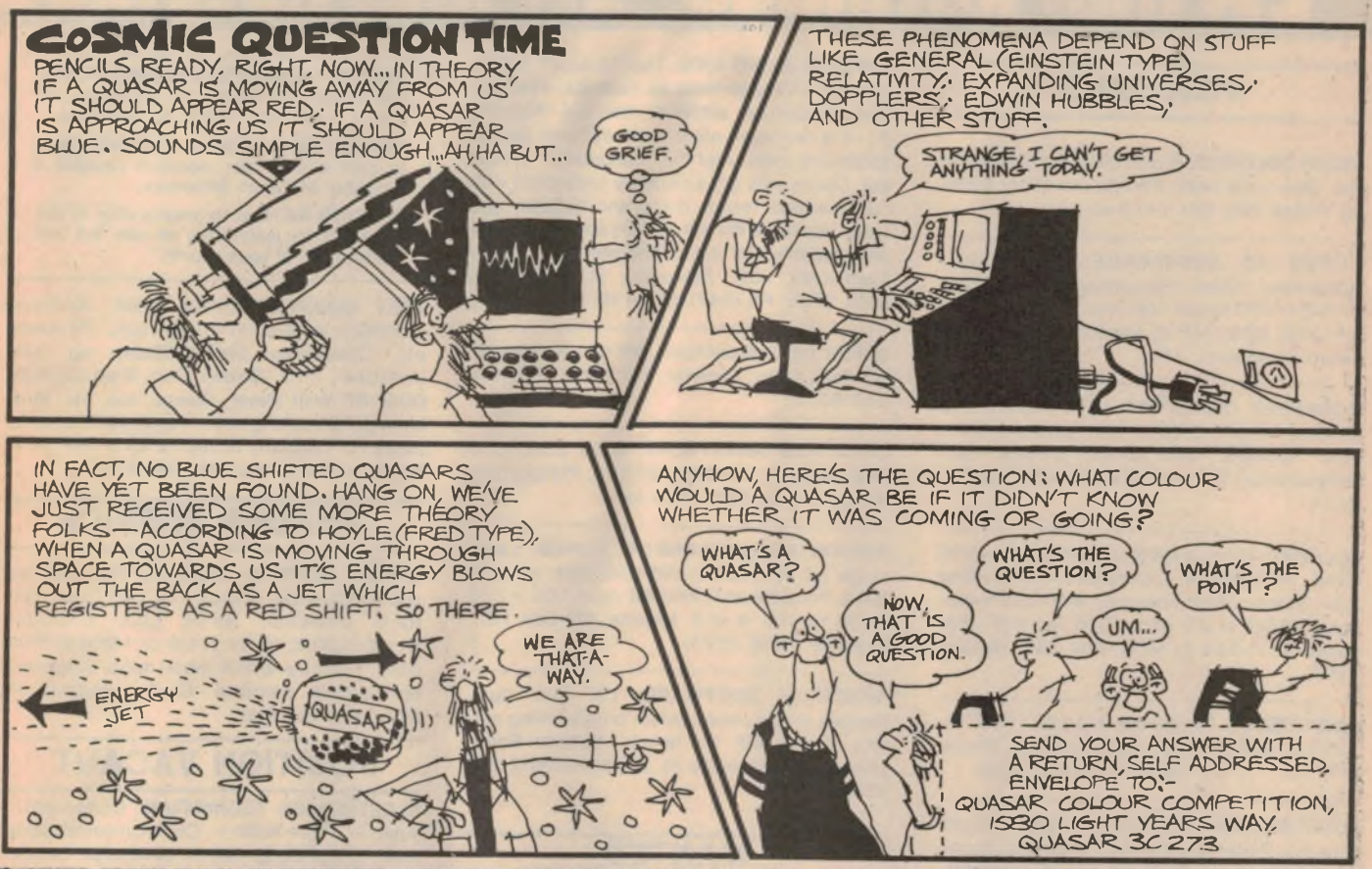
Valves fight on: A revolutionary development in electron valve design, hailed as one of the most significant advances in valve history, was announced recently by the Radio Corporation of America.

"Development of the new design represents a major breakthrough in tube size, performance, power drain, and reliability," said D. Y. Smith, vice-president and general manager, RCA Electron Tube Division. "It opens the way to mass production of high performance, thimble-size valves having improved ruggedness, reliability and efficiency."

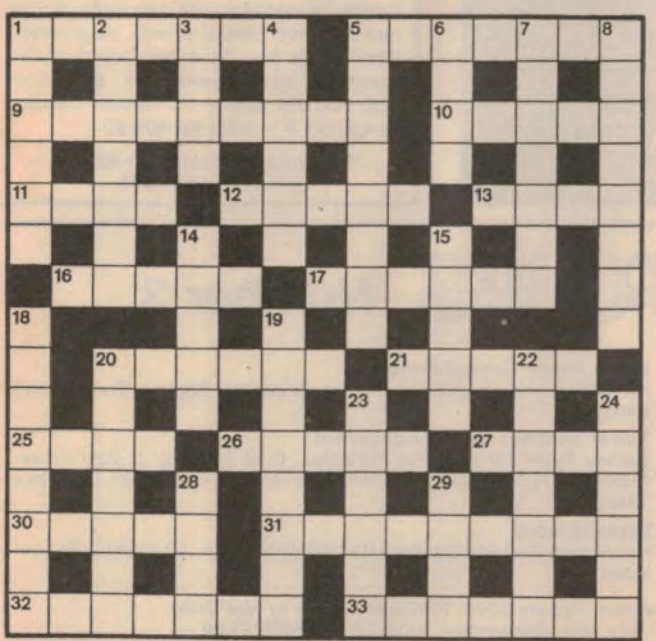
Called "Nuvistors," the valves could lead to new electronic developments in such instruments as television sets, communications receivers, and computers, as well as more compact and efficient electronic equipment for defence and industry.

Press-button telephone: Dialling a telephone number may soon be old fashioned in the US . . . instead you'll simply press buttons! Apart from being faster than dialling the new system will result in fewer wrong numbers, the telephone companies say. The new-style telephone is being tried out in a number of towns and cities across the country.

emerson's out of this world



MAY CROSSWORD



ACROSS

1. Affixed terminal, etc, to wire. (7)
5. Electronic communication organisation. (7)
9. How charges find their like? (9)
10. Minimum points in a standing wave. (5)
11. An in-word in terms of R.M.S. (4)
12. Famous atomic physicist. (5)
13. SI prefix. (4)
16. Eliminate errors in a program. (5)
17. Metal used in a discharge lamp. (6)
20. Universal tool. (6)
21. Type of electronic detector. (5)
25. Computerised betting system. (4)
26. Gap jumper! (5)
27. Obviously without charge. (4)
30. Rectifying device. (5)
31. Said of motor capable of operating on DC and AC. (9)
32. Unit of electrical conductance. (7)
33. Said of a communication channel with one-way operation. (7)

DOWN

1. Additive used in some magnetic tapes. (6)
2. Feature of coherent electromagnetic waves. (2, 5)
3. Lamp terminal. (4)
4. Said of forced oscillations. (6)
5. Particle emitted by a cathode. (8)
6. Signal path. (4)
7. Element present in certain cells. (7)
8. State where linked circuits have unequal impedances. (8)
14. Section of a TV receiver. (5)
15. Another section of a TV receiver. (5)
18. Thermionic valves having five electrodes. (8)
19. Regions of magnetic tape incapable of producing a signal. (8)
20. Basis of inverter transformer. (3, 4)
22. Makes a spray. (7)
23. Woven wires. (6)
24. Type of speaker enclosure. (6)
28. Fair sort of place to get second-hand radios, etc. (4)
29. Significant feature of a CRT. (4)

SOLUTION FOR APRIL

S	H	O	R	T	W	A	V	E		M	O	R	S	E
T			O		C		L		I		E	X
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EA marketplace EA marketplace

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- CPS (Computomatic Program Search)

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